THE REAL DISASTER IN OUR FUTURE (PAGE 7)

Backwoods Home magazine

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practical ideas for self reliant living

Plant a Y2K Garden

Chocolate-food of the Gods
Old-fashioned smokehouse
Self-reliant refrigeration
Ash-heated greenhouse
Open-pollinated seeds

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D. CHILDERS

Publisher's Note

Forget a run on the banks, we've had a run on BHM

Our last issue, the special "DOOM AND GLOOM" issue, sold out as soon as it hit the newsstands. It's the first time that has happened to this magazine. Luckily, I had anticipated it would be a popular issue so had a few thousand extra copies printed, enabling us to satisfy the requests of a barrage of phone callers, some of whom ordered 20 and 30 copies at a time—for friends and coworkers. We still have copies left if you missed it, and you can read some of the articles online at our web site: www.backwoodshome.com.

This issue we have no asteroid on the cover and no "DOOM AND GLOOM" banner, but we do have the letters, Y2K, big as doom to alert readers that our attempt to help you get ready for any future catastrophe is continuing. I've also ordered extra copies of this issue.

Which brings up a good point: How serious is the Y2K computer problem going to be? My answer may surprise many: Not very! Now that probably sounds like a blasphemous answer to a lot of Y2K vendors making a whole lot of money off the Y2K scare, and to a lot of people who just enjoy getting themselves all worked up about every doomsday train that rumbles into town. But it is my honest assessment after digesting all the literature and web sites.

There'll be some problems, sure, but the gears of American commerce will not grind to a halt, nor will supermarkets run out of food, nor gas stations out of gas. There may be some discomfort in the inner cities because people may not get their government checks for a few days, and the stock market may take a temporary hit because a lot of investors may pull their money out as a precaution, but that's about it.

The best part about all of this Y2K stuff is that people have stopped talking about the New World Order conspiracy, which is another phantom bogeyman. Not only do I think the Y2K problem is overblown, but it is diverting needed attention away from real problems, such as the potential worldwide economic collapse, the diminished state of our freedom in this country, or the imminent collapse of social security which is the subject of this issue's editorial. Next issue, John Silveira and O.E. MacDougal will try to put a lot of these disasters in perspective when they team up to discuss the odds of various catastrophes occurring.

www.backwoodshome.com

The traffic at our Internet web site is increasing rapidly. Based on last month's visits we are averaging between a quarter and half million visitors a year. The Internet is very important for the future of this country. It is equalizing all playing fields, allowing good ideas to compete on an equal footing with bad ideas, no matter how well funded those bad ideas are. The old guard media is rapidly losing its ability to control the news they make available to people, and publications like *Backwoods Home Magazine* are gaining a strong foothold because, thanks to the Internet, we all have a downtown store now, readily accessible to anyone. News control, such as has been practiced by the major media for years now, is becoming a thing of the past.

Dave Duffy

If you do not have an Internet connection now, make an effort to get one. New satellite phone technology will soon remove all barriers to Internet access. That is great news, because I firmly believe that the Internet will play a major role in restoring America's freedoms.

The book store

We've opened a small book store next to our main office in downtown Gold Beach, Oregon. It's at the southern tip of town, located at 29284 Ellensburg Avenue in Ireland's Plaza. We opened it simply to help defray the cost of renting the space as a storage locker for the many books we sell, and we'll open it to the public only on weekends for now, since that's the main time people get a chance to visit this area. If you're in the area please drop by and say hello. We'll even pour you a cup of coffee. If you're lucky you'll get a chance to talk politics and history with John Silveira and O. E. MacDougal, who like to hang out there. Silveira says he'll also autograph his book of poetry in person for all the pretty ladies who come by.

This is also a great little coastal town to visit. The forest creeps right down to the Pacific, squeezing Gold Beach against the ocean. The fishing, clamming, and crabbing are great, and there is plenty of spectacular rocky shoreline to explore. There are also lots of good, but inexpensive, motels to stay at, not to mention numerous campsites. Thirty miles to the south are the redwoods and not too far to the north is the largest land seal rookery in the United States. I should work for the Chamber of Commerce here. Δ

My view

The real disaster in our future

With all the talk about the various disasters looming in our future, I thought it would be a sensible idea to focus on a future disaster that is guaranteed, namely the impending collapse of the social security system and the severe consequences that collapse will have for America. All studies agree that this economic calamity will begin engulfing America about the year 2012, when my generation—the 76 million post World War II baby boomers—begin to collect social security. It has been called an economic time bomb that will spark a Generational War between workers and the retired and ultimately bring down the American economy and political system.

Although politicians of all stripes have agreed for years that something must be done, *and done now*, social security is known as the "third rail" of American politics, namely, touch it and you'll suffer political death. So our politicians, of course, have done nothing.

Here's the problem: Since its deceitful introduction as some sort of insurance plan in 1935, Americans have been led to believe that if they put social security taxes into the social security trust fund, they will get social security payments when they retire. Most politicians now admit that there is, in fact, no such trust fund, that the money paid into social security by workers today is immediately paid out to today's social security recipients. What money is left over goes into the government's general fund to pay other bills. The social security trust fund contains nothing but government IOUs called "special treasury notes."

This government fraud worked fine as long as the number of workers kept growing, much like a pyramid scheme works fine as long as you keep getting a fresh supply of suckers. Unfortunately, the number of American workers has been shrinking relative to the number of social security recipients, due mainly to a declining birth rate and an increasing life expectancy. In 1935, for example, there were 40 workers paying into the social security system for every 1 retiree receiving benefits, but that ratio had shrunk to 16 to 1 by 1950, and today it is just over 3 to 1. It will shrink to about 2 to 1 when I retire. To help prop up this pyramid scheme, our politicians have increased social security taxes 17 times, from an original 2% to today's 15.3% (including both employee and employer contributions).

Today more money is being paid into the social security system than has to be paid out to current social security recipients. But that will change in the year 2012 (sooner if we have a severe economic downturn) when baby boomers begin to retire. Then the government will begin paying out more than it collects. Since there is no money in the trust fund, the solution will be to 1) increase taxes again (to about 40%), 2) cut benefits and/or raise the retirement age, 3) cut government spending.

We know from past performance that the government is unlikely to cut spending, so a combination of the first two seems likely. Workers will get taxed to death and the retired will get less and less, creating a disgruntled work force and a huge retirement population slipping into poverty.

That's the best outcome. A more likely one, however, will be that neither workers nor retirees will stand for it. Workers will not accept paying huge taxes to support "their" retired person (2 to 1 ratio by then) with money they could be using for their own families, especially when it will be obvious by then that they themselves will get nothing from social security when they retire. The retired, on the other hand, will not accept being thrust into old age poverty. They'll think they are owed something, and since they'll control the vote due to their large numbers, they'll try to force workers to pay. It's easy to imagine destitute retirement ghettos, the emergence of a dominant underground economy, and the ultimate failure of our political system.

Here's the solution: There *is* a solution if it is taken now. It is to privatize social security, that is, allow people to invest in the private sector the money they now are forced to pay into social security. Chile and Great Britain have already done it, we have studied them to death, and anyone who knows anything about economics agrees we should follow in their footsteps *now*, before it too late.

Chile privatized their system in 1981, and to date 95% of Chilean workers have joined it. The results have been astounding. The average Chilean worker now retires at an average of 80% of the salary he earned during his last 10 years working, which is nearly double the percentage available in the U.S. social security system. And the huge cash reserves in the fully-funded pension system fuel phenomenal business and job creation, making Chile the soundest economy in South America. Great Britain is on a similar track, with their private pension funds already worth more than all the other pension funds in Europe combined. While the rest of Europe sinks deeper into debt and doubtful futures, England is paying off her debt, and retirees—at least those 75% of Britons in the private system—can look forward to a fully-funded pension.

So why won't politicians privatize our social security system in the face of the irrefutable evidence that it is a doomed system that will lead to disaster? That's easy: Privatization requires guts and honesty. What can those of you counting on social security do to protect yourself against winding up destitute in retirement? Open your own Individual Retirement Account (IRA) or something similar *now*, then vote those bastards out of office.

For more information on this real disaster in our future, go to these Internet Web sites: socialsecurity.org, economicsecurity2000.org, pensionreform.org, unitedseniors.org, and heritage.org/library/categories/forpol/bg1133. Δ

Grow open-pollinated seeds for self-reliant gardening

By Jackie Clay

In the past I've grown hybrid vegetables, mostly the varieties that have been developed to produce early yields. Because of this, I was able to grow things like sweet corn in northern climates. However, from a practical point of view I am dead set against them if you intend to incorporate them into a "self-reliant" gardening plan.

While these hybrids can taste good, I've found that most have been developed for commercial traits such as ease of shipping, holding saleable color and flavor for long periods, and for ensuring the simultaneous ripening of entire fields of a vegetable to facilitate mechanical harvesting.

The one big negative is that hybrid seeds do not produce true reproductions of the mother plants. This makes buying new seed every year a necessary, expensive, and for someone who wants to become self-reliant, a dangerous practice.

Monsanto has gone one step further in developing the "Terminator Gene" in field crops, which renders the seed produced in a farmer's field sterile.

So, what happens if something unforeseen happens and we cannot afford to buy seed, or seeds just are not available when they are direly needed? The last year I grew hybrids —for market gardening—my seed bill ran over 150 dollars for three acres.

As a hard-core gardener, I believe in not only storing up at least a year's supply of food in the pantry, but growing and saving open-pollinated seeds for future planting. This allows me to be in control of our garden.

Open-pollinated veggies

There are several common complaints about open-pollinated vegetables. The first is that they don't taste as good as hybrids. This is just plain wrong. For the last five years my family has been gathering and growing traditional, heritage varieties, largely from the Native American tribes of the U.S. and Mexico. With our family's Indian roots, we initially did this out of curiosity, but we continued when we discovered some great tasting produce. Our ancestors had cultivated these vegetables for generations for exactly that reason. But, besides taste, most have had other benefits such as productivity, tenderness, winter storage, and hardiness.

Take my Hopi Pale Grey squash as an example. Five hills of squash produced two wheelbarrows heaped full of squash that are sweet and fruity tasting. They are much better than the plain-old hubbard or butternut squash. They are not stringy, but moist and tender. And they last in storage for better than a year.

By storage, I mean minimal care, under-the-bed storage. In fact, I have three right now under our clawfoot bathtub that are a year and four months old and will taste great when we get around to eating them.

On the other hand, where some hybrids excel in sweetness and lasting ability in the fridge, they've lost such flavor traits as "corny" taste and tenderness.

A second complaint is that open-pollinated vegetables don't grow big. This is often true. But while some hybrids, such as pumpkins and tomatoes, do get very large, our family would rather have such qualities as winter storage capabilities, intense flavor, and tenderness that are found in open pollinated varieties.

A third complaint is that they aren't as uniform. And this is absolutely

David, 8, samples some True Gold open-pollinated early sweet corn.

true. Open pollinated varieties are not uniform. But as a home gardener, I don't necessarily want all my broccoli to mature at once and I don't need all my squash to be exactly the same size and shape. In fact, one of the delights of growing Native American squash is that they are different, often one from it's brother on the vine, lending beauty to the oft-drab squash patch.

Saving seeds

Anyone can save their own garden seeds. Saving seeds takes very little effort and costs nothing after the first seeds are purchased. And you cannot only save your own seeds, you can pass them on to friends, relatives, and those in need.

The gift of food-bearing seeds is seldom taken lightly. Seed saving dramatically cuts gardening costs. Once you establish your own family seed bank, you will quickly notice that the cost of raising your family's food has shrunk to a tiny amount.

Growing open-pollinated varieties also allows you a vast choice in old-time traditional vegetables. You won't believe how many open-pollinated varieties are available from both growers of family heirlooms and seed houses, nationwide. While our family limits our choices to Native American crops, you can grow all sorts of ethnic vegetables that are open-pollinated. These include African, Italian, Amish, Russian, Greek, regional U.S., and many other vegetables. Every culture has its own.

Most open-pollinated varieties were developed over generations for hardiness in hostile climates, and growing through drought, wind storms, hail, and flooding. They had to adapt, and that adaptation produced extreme hardiness.

Basics for seed savers

Vegetables come in two types. The first is annuals such as corn, beans, and peas, which you plant each year and harvest seeds from in that same year. The other is biennials like cabbage, cauliflower, onions, and beets, which you plant one year, but the seeds are not harvested until the following year.

Saving seeds from biennials takes a little more work since, in most climates, the plants to be saved for seed must be heavily mulched in the garden row or they must be stored in a root cellar over the winter so they can be replanted the following spring.

Gardeners must take care to keep their seed stock pure as some vegetables will cross-pollinate, creating a hybrid of uncertain productivity. The safest method to keep seed stock pure is to grow only one variety of each species, that is, one sweet corn, one pepper, one squash, etc. But few of us actually do this, opting for a few "cheater" strategies instead. For instance, I'll plant a flour corn with late maturity dates alongside an early sweet corn. And, as they pollinate weeks apart, both remain pure.

Remember that some vegetables, such as corn, are wind-pollinated, and will cross with the neighbors' corn or local field corn if their pollination dates are the same.

We grow several different peppers, both sweet and chile. I get by, avoiding cross-pollination, by making little "houses" over seed plants to prevent insect and wind cross-pollination. As peppers also self-pollinate, this practice gives us pure seed from many different varieties. The peppers destined for the table and pantry are not so protected, as we do not save seed from them and the cross-pollination does not affect them the first year.

For such crops as squash, of which we grow several kinds, I choose one squash of each of the four squash families. Generally, these will not cross-pollinate, giving us a great variety of squash each year.

You can check out which crops will cross by looking at their scientific name in a seed catalog. Crops with the same name will cross. Luckily, though, many are largely self-pollinating, and minimal spacing is required to keep seed stock pure. Beans and tomatoes are two common examples of such "easy" crops.

Seeds must be mature to save. Thus, save a few cucumbers from the pickle jar, leaving them to get huge and yellow; let several peppers stay on the vine until they get red; let summer squash mature until they look like garden submarines; allow a few stalks of sweet corn to get hard and dry.

Some seed may be saved from the vegetables you harvest to eat. These include winter squash, pumpkin, watermelon, muskmelon, dry beans, and sunflower seeds.

Mold and birds are the two biggest enemies of the seedsaver. All mature seeds must be kept from molding once they are harvested. And many birds, even your own chickens and turkeys, will open and gobble very mature produce to eat both the meat and seed. Some crops, such as sunflowers and amaranth, are also very tempting to your feathered friends, so when they are bearing fruitful seeds, it's best to

slip a pillow case over them, tying it loosely around the stem.

While most seeds are simple to harvest, requiring only stripping out of the mother fruit, some, such as tomato and cucumber, require a different approach, as it is too time consuming to get the seeds separated from the pulp. With these crops, pick ripe fruits, scoop out the seed-bearing pulp into a bowl or jar, add enough warm water to cover them, and place in a warm area such as the back of your counter for a couple of days. The pulp ferments and lets go of the seeds. After this happens, carefully rinse the fermented pulp-seed mass through a colander and soon only the seeds will be left. Spread these on a cookie sheet or pie plate and let them dry in a protected warm area.

When the seeds are very dry, place them in paper envelopes, then in an airtight glass jar. I usually skip the envelopes for large seeds such as corn, beans, peas, squash, and pumpkins, but I leave the jar top off a few days in a warm, dry place to complete the drying. The tiniest bit of moisture will cause mold in your seeds, ruining them.

Seed storage life

Generally, stored seeds will last for years. I've seen charts in seed catalogs and other literature, giving minimal storage dates for seeds, such as three years for sweet corn, a year for carrots, and so on. But I've got 10-year-old sweet corn seed that germinates at 90%, and I've planted beans that were over 700 years old and they sprouted and grew well. Heck, they've found wheat seeds in Egyptan tombs and planted it and it has sprouted.

So, you should keep your stored seed as fresh as you can, using the oldest seed and replacing it with new seed, but don't worry if it gets a little old. Only onion seed is finicky, lasting for just a year or two before losing germination ability. Carrots, beets, and parsnips can be short-storers too, lasting about two to four years.

Run a germination test

When in doubt, run your own germination tests before planting in the garden. To conduct it, sprinkle a few seeds on a wash cloth, lay it in a pie plate, and soak lightly with warm water. Keep it warm and moist until germination occurs—from two days for some varieties up to three weeks for others. If only a few seeds germinate, they are too weak and no good. If half or more germinate, plant thickly and they'll be okay. If most of them pop roots, your seed is in great shape.

If, as a self-reliant gardener, you get in the habit of raising your own seed, you will never be caught with your seed supply low. And once you start experimenting with all the neat open-pollinated varieties, you'll truly be hooked and you'll find that saving seeds from these old-time jewels is not only provident, but a lot of family fun. Our eight-year-old homeschooled son, David, can tell you a lot about cross-pollination, seed saving, and "having to" eat up a sloppy, delicious watermelon, just to get the seeds.

Sources

Abundant Life Seed Foundation, P.O. Box 772, Port Townsend, WA 98368

Bountiful Gardens Ecology Action, 5798 Ridgewood Rd., Willits, CA 95490

Native Seeds/Search, 526 N. 4th Ave., Tucson, AZ 85705

Seeds of Change, P.O. Box 15700, Santa Fe, NM 87506-5700

Seed Dreams, P.O. Box 1476, Santa Cruz, CA 95061-1476

Southern Exposure Seed Exchange, P.O. Box 170, Earlysville, VA 22936

Suggested reading

The Garden Seed Inventory by Kent Whealy; Saving Seeds by Marc Rogers; Seed to See: Saving our Vegetable Heritage by Suzanne Ashworth Δ

The lying I did

The lying you did
Didn't hurt as much as
The lying I did

To myself,

And the reasons you gave
For leaving
Again and again,
Though not truthful,
Were more honest than
The lies I've told myself over the years
To keep myself from leaving you.
And the biggest lies I told
Were when I remembered
Only the good times,
Even though I knew, all along,
It was the bad times,
And the pain,
And the lies
That were real.
So I hung in,
Year after year,
Like the mother
Who will not give up a dead baby
For proper burial,
But holds onto it,
Hoping it will come back,
Until the rotting corpse in her arms
Convinces her otherwise.

John Earl Silveira
Ojai, CA

BUILD AN OLD-FASHIONED SMOKEHOUSE

for delicious meat and better storage

BY REV. J.D. HOOKER

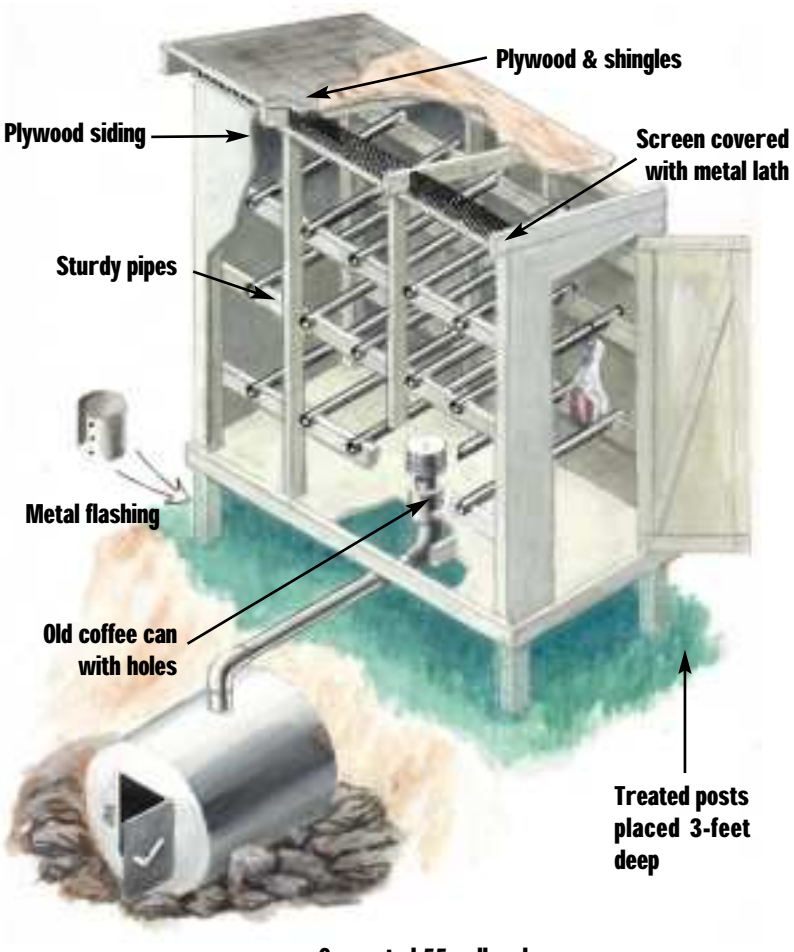
I'm not at all surprised at the large numbers of smoke cookers that I've been noticing among so many rural folks, and among many urbanites as well. Just about any sort of meat, fish, or fowl prepared using this sort of cooking method ends up tasting truly delicious.

Still, about all that you can get from these smoke cookers, or hot smokers, is flavor, as the keeping qualities of foods prepared in this manner is not enhanced at all. The only method that I know of which can lengthen the keeping qualities of such meats, while allowing you to enjoy this same unique taste, involves building a standard old-style smokehouse, and using cold-smoking methods.

Sure, many commercial meat processors still employ this style of smokehouse, yet theirs are usually huge, commercial set-ups. For the use of a single family, a simple four-foot by eight-foot shed of approximately seven feet in height will handle all of the meat preserving needs you could encounter. Such a simple smokehouse can provide you with 220 cubic feet of smoke-filled area, and it is still easily put together using standard sizes of plywood and lumber.

Once you've selected a site to erect your smokehouse (the top of a slope is ideal), begin by making corner cut-outs in your sheet of ¾-inch plywood. As an aid in marking out where to dig the holes for setting the building's corner posts, lay this plywood flat on the ground. You'll then need to use a post hole digger to sink holes deeper than your local frost line (three feet in our area).

Next, you'll need to use a level to keep each corner post plumb as you tamp the dirt solidly back in place around them. Then measure down exactly 8 feet from the top of the tallest posts, and again use your level to keep everything "true" as you install the floor joists and ¾-inch plywood flooring, as shown.



MATERIALS LIST:

To erect your own smokehouse in these dimensions, you can either design your own, or go by the following materials list and guidelines:

2 pressure-treated 4"x4"x14' (cedar, locust, or other rot-resistant wood can be substituted).
2 pressure-treated 4" x4"x 12'
5 2"x4"x10' lumber
18 - 2"x4"x8' lumber
3 - 2"x4"x12' lumber
7 - 4'x8' sheets of 3/8" plywood or OSB board
1 - 4'x8' sheet of 3/4" plywood or OSB board
1 roll of metal roof flashing
1 square worth of roofing material
18 4-foot long pieces of 3/4" iron gas pipe or other sturdy pipe
2 - T or strap type hinges
20 feet of 1"x 2" lumber
several yards of heavy gauge wire
10 or 12 feet of 24-inch wide window screen
10 or 12 feet of 24-inch wide expanded metal lathe
12d and 7d nails, and roofing nails

Now, nail the wall studs and roof rafters in place, then cover the exterior of the walls and roof with the 3/8-inch plywood, making certain to provide a doorway. You can build it like the one illlustrated, or use your own variations.

As shown in the illustration, use the 1"x2" lumber to fashion braces for the section of plywood removed for the doorway. Use the hinges to hang this in place as a door. A lock and hasp, a simple barrel bolt, a large hook and eye, or anything similar can be used to keep the door shut.

Install whatever sort of roofing material you prefer. For our family's use, I found the painted canvas type roof which I've written about in issue #39 of *BHM* ideal for this purpose.

To prevent rodents and other animal pests from climbing up and gnawing their way into your smokehouse, you'll need to cover the exposed portions of your four corner posts from the ground to the floor joists with metal flashing. The smooth surface of the flashing prevents rats, cats, and other creatures from getting any sort of a hold to climb up.

At this point, you'll want to brush on a couple of coats of non-toxic exterior paint, both inside and outside of your smokehouse. For the interior I picked a glossy white latex exterior paint. It makes scrubbing down the smokehouse interior after each use just a little easier.

Instead of using wood to fill in the spaces between the rafters, use fine window screen and metal lathe to cover each of these spaces. This will allow the smoke to slowly escape, which prevents imparting a stale, flat taste to your foods.

As shown, notch 12 pieces of 2"x4" and nail them in place along the long sides of the shed. These will support the lengths of pipe from which you will hang your food. When larger pieces of meat are to be smoked, extra support is added with heavy gauge wire suspended from the rafters.

All that remains to be done before putting your new smokehouse into use is to provide a means of keeping the building filled with smoke. One good method for doing so is shown in the illustration. The only things you need for this method are a 55-gallon metal drum, some 6-inch stove pipe, one short section of 6-inch triple wall pipe to go through the floor, and an old three-pound or larger coffee can.

When you're ready to use this stove to provide smoke for the food in your smokehouse, you'll need to build up a hot fire of hardwood, such as hickory, oak, or ash, and allow this fire to burn down until the bottom of the barrel is filled with hot glowing coals. Once the coals are ready, shovel dampened hardwood sawdust, ground corn cobs, shredded hickory bark, or something similar over them. Keep shoveling in more of this damp (not wet) material every hour or two, as needed. It wouldn't hurt to add a small outdoor thermometer inside the door of your smokehouse, because once the original large fire has burned down, you'll never want the inside temperature to exceed 100 degrees F.

While you do need to stick with hardwoods for smoking foods, to avoid a nasty taste I recommend doing some experimenting on your own with different species of sawdust, wood chips, ground-up corn cobs, and such to determine the flavors you personally prefer. My family especially likes hickory or corn cobs for hams and bacon, a mixture of apple wood and corn cobs for beef and venison, sugar maple for waterfowl, and a mixture of hickory and beech for chicken, turkey, and upland birds such as pheasant. You may wish to give these a try for starters, adjusting the wood species to meet your own tastes.

Some meats, such as thinner cuts of lean beef and venison, will not only have their flavors greatly enhanced, but their storage lives extended remarkably by smoking. Many other foods, especially fatty meats like pork, most fish, and many sorts of fowl, require some type of curing (usually employing salt, sugar, syrup, or some combination of these) before the meat is smoked, or its keeping qualities won't be much improved, if at all.

Before giving you a few of the curing methods that we've found especially to our liking, I probably should mention that all meats seem to spoil quickest close to the bone. For this reason, I've always boned out all of the larger pieces of meat intended for our smokehouse, and employed only dry type cures on these larger pieces, packing the "hollows" where the bones used to be with the cure mixture.

The following are some of the curing methods which our family routinely uses:

Dry cures

For Fish: Clean each fish and wash thoroughly in clear water. Make a brine mixture using 1 cup of salt per gallon of water. Soak the fish in this brine for 30 minutes to draw out any blood remaining in the fish. Then rinse very well in cold fresh water and set aside to drain. Spread a thin layer of pickling salt in the bottom of a large plastic, glass or stainless steel container. Add a single layer of fish and another thin layer of salt. Continue alternating layers of fish and salt, until the container is filled, or all of the fish has been used up. Refrigerate the container with the salted fish for 48 hours.

Rinse the fish thoroughly and scrub away any particles of salt, then hang the pieces of fish in a cool, shady spot for about four hours, until the surface is covered with a shiny "skin."

Use pieces of stiff wire, bent into an "S," to hang all of the fish on the pipes inside your smokehouse. Keep the smokehouse filled with very dense

smoke and leave the fish inside for a full five days. Remove the fish and wrap each one separately, then store in a cool, dry place.

For waterfowl: Soak the bird overnight in a seasoned brine, made by adding 3 cups pickling salt, 1 cup of brown sugar, 1 tablespoon black pepper, and 6 or 7 whole cloves per gallon of water. Then rinse well and pat dry. Rub pickling salt very heavily inside the body cavity. Place the bird on top of a thin layer of pickling salt inside a plastic, glass, or stainless steel container. Coat the outside of the bird as heavily as possible with pickling salt and refrigerate for 48 hours.

Rinse very well with cold, fresh water, then pat dry. Hang in a cool place, out of direct sunlight, for 5 hours. Then hang the bird inside the smokehouse, which is then kept full of very dense smoke for 7 days.

For hams, shoulders and bacon: For each hundred pounds of meat, mix together 2 pounds of dark brown sugar, 8 pounds of pickling salt, 2 ounces each of black and red pepper, 2 ounces of saltpeter (optional), and 1 ounce of crushed cloves. Dampen the meat well with fresh water and rub this mixture well into all sides of the meat. Place a layer of pickling salt in the bottom of a wooden or plastic barrel, then place pieces of meat on top of this layer of salt. Cover this meat with a thin layer of salt. Continue alternating layers of salt and meat until the container is full or the meat is gone. Make certain to finish with a layer of salt on top. Every six or seven days, the barrel should be unpacked, the pieces of meat rubbed again with the salt/sugar spice mixture, and then repacked using the same salt.

Using the largest piece of meat as a guide, leave the meat packed in the pickling salt for three days per pound.

At the end of the curing time, wash the meat thoroughly and hang it to dry inside the smokehouse (without using any fire or smoke) for 24 hours. Then build up the fire, and keep the smokehouse filled with dense smoke for 12 days. After smoking, wrap the meat in a double layer of cheesecloth, then in brown butcher's paper, and hang in a cool dark place to "age" for at least 3 months before using.

For beef, venison, and other red meats: Entire shoulders, whole rib or round cuts, or whole briskets, can be boned for this sort of use.

Refrigerate the meat for at least 24 hours before starting to cure. Use approximately 5 pounds of pickling salt and 2 ounces of saltpeter (optional, but without the saltpeter, your meat won't retain a fresh reddish color), per 100 pounds of meat. Place a thin layer of this mixture in the bottom of a wooden or plastic barrel, then add a layer of meat. Cover the meat with this mixture, then sprinkle on black pepper and garlic powder liberally. Add another layer of meat, treating it in the same manner. Keep alternating layers until the barrel is full, or all of the meat has been used up. After 24 hours, weigh the meat down with a wooden lid with a couple of scrubbed, heavy rocks on top.

After 60 days, remove the meat and dry each piece separately. Rub each piece heavily with a mixture of 6 parts black pepper, 5 parts coriander, 3 parts allspice, 1 part white or red pepper, and 1 part garlic powder. Refrigerate overnight.

Hang the meat inside of the "unlit" smokehouse to dry—and "set up" a little—for 24 hours before smoking. Then keep the smokehouse filled with very dense smoke for 12 days. Wrap with a double layer of cheesecloth, then a layer of butcher's paper, and hang to "age" for a couple of months before using. Once aged, roasted, and thinly sliced, venison cured and smoked in this manner tastes remarkably like deli-store pastrami.

Many other foods aside from meats can have their flavors enhanced by leaving them inside of your smokehouse for a few days. Most cheeses, especially cheddar, can be placed inside of bags made up of cheesecloth and hung inside the smokehouse for from 2 to 4 days. For a real taste treat, pecans, almonds, cashews, hickory nuts, and many other nuts can be roasted in vegetable oil, then hung in the smokehouse to absorb the extra flavor for a day or two.

Possibly the best-tasting homemade chili powder that I've ever encountered was prepared from dried red peppers which had hung in the smokehouse for about 3 days before being ground into a flour-fine powder.

If you're interested in preserving some of your own meats, fish, game, fowl, and other foods at home, while allowing yourself a real taste treat, then building and using your own family-sized smokehouse is exactly what you're looking for.

Good eating. Δ

Keeping your food COLD

By Michael Hackleman

Solutions to refrigeration when electricity is scarce

Many readers of this magazine live in remote settings and generate their own electricity, often through solar, hydro, wind, or generator machines, storing the electricity generated in batteries. In such a scenario the electricity produced is dear and needs to be used efficiently. Since refrigeration is a major consumer of electricity in a home, the essence of this article is efficiency. The goal: gaining the most refrigeration for the least amount of energy consumption.

Over the years, I've helped design the energy systems for a variety of places and situations, and visited many others. Invariably, I'll find a stock refrigerator squatting in some corner of the kitchen. If it's an electric one, it's obvious that the house must have a grid (electric utility) connection. Or a large inverter. Or there's a standby generator someplace nearby. If it's a gas unit, there's a corner with a few five-gallon bottles that rotate between the gas line at home and the gas line at the nearby LP (liquified propane) station.

Refrigerators *are* complex gizmos, and it *is* understandable that most folks don't want to mess with them. However, ranging from simple to involved, there are nearly 30 changes I can list (see opposite page) that will reduce the energy consumed by refrigeration.

Refrigerators are fairly low-wattage devices. In the standard household, they *nibble* energy whereas tools, motors, and other important electric appliances, such as stoves, water heaters, air conditioners, toasters, and blenders, gobble it up. Where's the problem? While refrigerators don't consume energy at a very high rate, they *do* work the equivalent of an eight-hour day. In consequence, they may easily consume, in a day, week, or month, the lion's share of available electricity.

What can you do? Quite a bit.

The first thing is to understand how refrigerators work. Ever wonder how they "make" cold? Heat is absorbed in the interior (where you put the food and ice trays), transferred by a suitable refrigerant such as Freon or ammonia, and dissipated outside, usually at the back of the refrigerator (see Fig. 1).

The second thing to know is that, while "heat pumps" are generally very efficient, refrigerators are not shining examples of that fact. Can the situation be remedied? Faced with the same question a few decades back, I began an exhaustive study of the problem. It soon became clear that I was dealing with more than just poor

Things to consider when considering refrigeration

(This numbered list tracks the article)

Operation practices

1. Minimize frequency/duration of open door
2. Check the door gasket
3. Don't overload the refrigerator
4. Correctly set the dial thermostat
5. Re-examine refrigerator's contents weekly
6. Evaluate the refrigerator's size

Siting

7. Maintain clearance around refrigerator
8. Design alcoves properly
9. Consider alternative refrigerator sites

Design changes

10. Trade in frost-free units
11. Insulate the refrigerator
12. Re-locate the HDC (heat-dissipating coils)
13. Build a hybrid refrigerator/water heater
14. Use a horizontal refrigerator

Power conversion (electric)

15. Use a 110-volt AC standby generator
16. Use an inverter
17. Modify the motor-compressor unit
18. Replace the motor-compressor unit
19. Use a battery charger

Power conversion (gas)

20. Convert to the correct fuel
21. Modify for AC or DC

Purchasing a new refrigerator

22. Buy & convert an old 110-volt AC model
23. Buy an RV or PV-type unit
24. Find and buy a gas refrigerator
25. Build a solid-state refrigerator

Refrigeration alternatives

26. Build and use a root cellar
27. Learn canning for foodstuffs
28. Dehydrate your food
29. Control your food supply

design, engineering, or construction of the refrigerator. What about operator abuse? Improper siting? A mismatch between the power available versus the power required? Also, what about alternatives to the refrigerator?

In the following sections—**Operation**, **Siting**, **Design changes**, **Power conversion**, **Purchasing a new refrigerator**, and **Refrigeration alternatives**, I will detail the answers I found. Wherever possible, I will describe specific situations and solutions. Don't expect me to tell you exactly what to do. Your situation is unique. Ultimately, only you are qualified to identify problems and apply appropriate solutions.

Are the issues I'll discuss worth the effort of change? Obviously, much will depend on which ones you'll identify as troublesome and choose to rectify. However, some of the these solutions, which were applied to a stock refrigerator matched to a low-voltage DC wind (power) system at a remote retreat in the California Sierras in the early 80s, reduced the energy consumption from 150 kWh per month to a mere 30 kWh. Today you may purchase high-efficiency refrigerators which will match or beat these numbers.

Operation practices

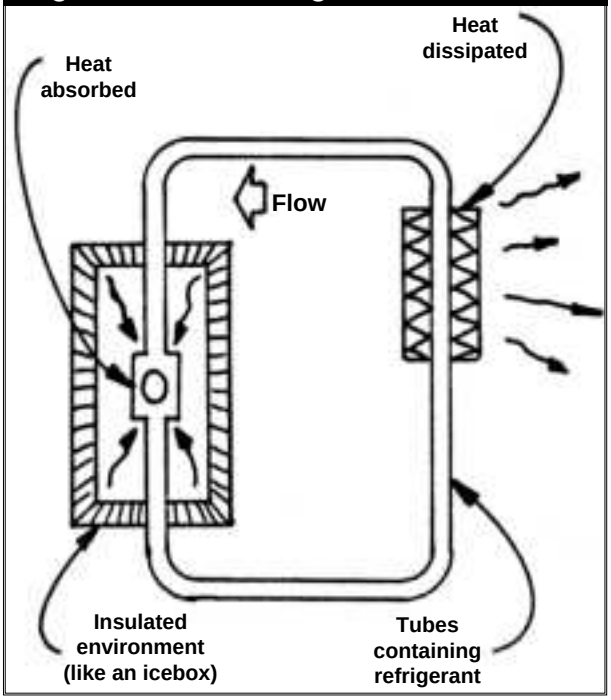
New refrigerators usually come with an operator's manual. A proud new owner may even read it from cover-to-cover. After that, it's put away and, eventually, lost. That's too bad. A poorly operated refrigerator is an inefficient one.

This section is devoted to proper refrigeration operation. Apply this information and you will easily *halve* your refrigerator's present consumption of energy—gas or electricity.

1. Minimize both the frequency and the duration of door opening(s). Cool air, and the energy it takes to make it, are lost every time you open the door of an upright refrigerator. Before you open the door, decide what it is you're after. And, if it's breakfast, lunch, or supper you're fixing, get everything you need at one shot; one long opening is less wasteful than item-by-item door openings which "fan" cold air out and warm air in.

2. Check the door gasket. The gasket which seals the door against the main body of the refrigerator keeps heat out and "cool" air in. How do you know whether it is, or is not, sealing? Open the door, place a sheet of paper against the face of the seat, and close the door. Does the gasket hold the piece of paper in position when you let go of it? Does it offer some resistance to your pulling the

Figure 1: Basic refrigerator functions



sheet out? If not, the seal is not adequate.

Sometimes the problem is just a dirty gasket or seat face; clean both well and re-test. Or the door may be misaligned. Does it seal at the top but not at the bottom? If not, loosen the hinge bolts and have someone push the door firmly against the refrigerator body as you re-tighten them. If that doesn't work or there's no adjustment for the door hinges, you may have a warped door. Here, the only solution is to find a new refrigerator door. Or another refrigerator.

More often than not, the source of the problem is the gasket itself. After years of hot and cold, open and close, the rubber gets tired, old, brittle, and torn. This is replaceable; check with the manufacturer about a new one. If it's an old refrigerator, you may want to consult with an appliance store or a refrigeration man about a new gasket. The price is not cheap. In early 1982, a replacement gasket for our own refrigerator cost $50. Shell it out, though; makeshift gaskets are impossible to clean and require frequent replacement.

3. Don't overload the refrigerator. Packing a refrigerator full of foodstuffs is an invitation to poor performance. In order to cool quickly and effectively, sufficient space must be left around the individual food containers or packages to permit heat to escape and be absorbed by the refrigerant. Also, allow foods to cool before placing them in the refrigerator; hot foods only make the refrigerator work harder and longer. If you're rushed, food will cool more quickly if the container is placed in room temperature water in the sink for 5-10 minutes before inserting it in the refrigerator.

4. Correctly set the dial thermostat. Different foods have different refrigeration needs. This ranges from frozen to something just below room temperature. Recognizing this need, manufacturers provide an operator control, the dial thermostat, which will adjust the interior temperature over a 15-30 degree F temperature differential. There are numbers on the dial; they range from 1 to 10, with an 0, or "off" position. The higher the number you set, the *lower* the temperature in the refrigerator's interior.

This dial adjusts cooling by adjusting the "duty cycle" of the refrigerator. Therefore, a low (number) setting asks for mild cooling. Here, the motor-compressor unit (the device which actually performs refrigeration) is "on" infrequently and for short durations. A higher setting of the dial calls for lower temperatures. Consequently, the motor-compressor will be "on" more often, and for longer periods of time.

If you want to minimize your electric bill, it's up to you to correctly set the dial thermostat. Of course, you've no way of knowing just how low a number (how high an interior temperature) you can select which will keep things from spoiling. Or do you? The dial must be presently set to some value right now which *does* the job or you'd have turned it up higher, right? So, decrease it one number and wait a few days. If all's well, lower it by one more number. Repeat until you begin to notice that it's not doing the job as you wish it to—the time it takes to cool things, the butter's soft, etc. Then kick it back to the previous number and give it a day or two to fully recover.

5. Re-examine the refrigerator's contents weekly. A refrigerator doesn't *prevent* spoilage; it *delays* it. It doesn't matter what section the food occupies; even frozen foods have a very short lifespan (six months?). Sure, the food may be digestible and even palatable, but it definitely has less nutritional value, and it may taste or look funny. A periodic review is a good policy.

6. Evaluate the refrigerator's size. If your present refrigerator seems too small, clean it out and stop putting non-perishables in it. You may be surprised to find out that it *is* the right size. And, if you think your refrigerator is adequate, apply the same treatment; you may discover that it's really bigger than what you need. Don't rule out the possibility of getting a smaller one. In the long run, the energy saved will pay for the swap.

Siting

Often, very little attention is given to the siting of a refrigerator—beyond convenience, the availability of space, or the firm belief that it's got to go *somewhere* in the kitchen.

At least some consideration *should* revolve around the specific needs of the "coolworks." The coolworks is my own term for the refrigerator's

machinery—electrical and mechanical—which performs the magic act of refrigeration. More specific names are given to these component parts: motor-compressor, heat-dissipating coils, expansion valve, refrigerant and plumbing, thermostat, interior light, and electrical wiring (see Fig. 2).

In the interest of good looks, compactness, and transportability, a number of design factors have been severely compromised in domestic refrigerators. By far the most flagrant violation is the positioning of the heat-dissipating coils (or HDC). These are designed to dissipate the heat which is pumped out of the refrigerator's interior—principally through convection. Unfortunately, they're *not* aesthetically pleasing enough to put anywhere but out of sight—behind the refrigerator or below it. Siting of the refrigerator, then, may aid or impair the proper functioning of the HDC.

7. Maintain clearance around the refrigerator. Note how far the HDC project from the back of the refrigerator, and maintain at least that distance—more if you can spare it—between the HDC and the wall. This will assure an adequate passage of air past the HDC during refrigerator operation. If you pull out the refrigerator for a periodic cleaning, take care to maintain the correct distance when it's shoved back in.

For the air to get to the HDC and back out again, you must also maintain adequate clearance below and above the refrigerator. The manufacturer allows for this in the design, but space directly beneath the refrigerator can become clogged with dustballs, stray toys, and other unmentionables that are swept or have crawled under it. Sweep the space under the refrigerator. If it's too close a fit to get at from the front, make some allowance so the refrigerator may be pulled out for cleaning.

8. Design alcoves properly. Flush-fitting (recessed) refrigerators look good but prevent proper airflow to the HDC without good design. In some instances, a strip of fancy grillwork directly below and above the refrigerator in the wall partition will assure, respectively, a good inflow and outflow of cooling air. Or, if this doesn't appeal to you, install a vent in the floor or lower wall, and another at the top of the wall *behind* the refrigerator so that waste heat exits the house. Either way, maintain the proper clearance between the back of the refrigerator (and its HDC) and the wall.

9. Consider alternative refrigerator sites. The heat pumped out of the refrigerator has to go somewhere. If your refrigerator is unmodified, that heat is dumped into whatever room it's sitting in, usually the kitchen. No big problem in winter as the extra heat is always appreciated, but unacceptable in summer. After all, it's a shame to do such a good job of insulating your home to keep out the summer's heat and get stuck with the heat that's dumped into the kitchen from the refrigerator.

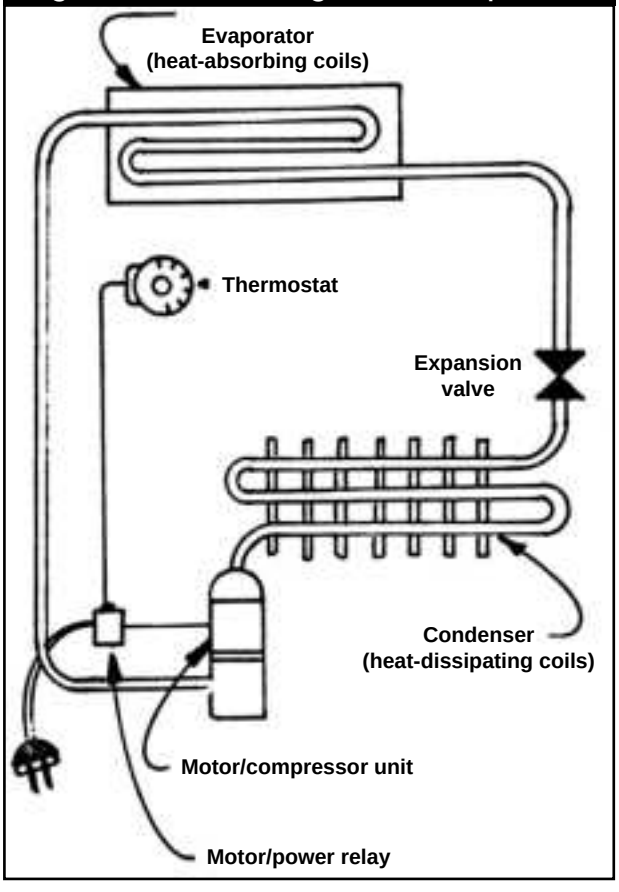
Insignificant, you say? Even the smallest upright refrigerator is working at about one-third the capacity of a 1,200-watt floor heater—for six hours in each 24-hour period. A larger refrigerator, particularly the frost-free variety, *equals* the output of that heater. That's a truckload of Btu (British thermal units). How do we get around this problem?

One way is to locate the refrigerator outside. Admittedly, this is rarely practiced. Unless it was sited in a cool, shady spot, it could use *more* electricity during the summer months. Remember, the larger the temperature difference between the inside and the outside of the refrigerator, the more energy it takes to keep things cool.

On the other hand, you could put the refrigerator into a cool place—a well-insulated pantry, a root cellar, etc, and *decrease* the temperance difference (between the inside and outside of the refrigerator) to aid in efficient refrigeration. This starts out as a good idea, but the HDC will increase the temperature of an enclosed space during operation. A pantry might tolerate it but it would be self-defeating in a root cellar.

One idea is to cut an opening in a north-facing wall and slightly recess the refrigerator in it. This way, you have access to its contents, but the back of the refrigerator, HDC included, dissipates its heat outside.

Figure 2: Basic refrigerator components



Design changes

Refrigerators are pretty good at what they do, but, alas, they are handicapped by design compromises. Ninety-five percent of manufactured refrigerators suffer the same disadvantages. However, look on the bright side. If most of them experience the same problems, each "solution" we find will fit almost any refrigerator. As well, most of these problems are only "delivered" ones—the way the package arrives at our house—and *not* intrinsic to the principles of refrigeration. Some are a matter of knowledge and judgement, and others require some handiwork by the owner.

10. Trade in frost-free units. Newer, so-called "modern" refrigerators incorporate a frost-free circuit. This is supposed to liberate the busy housewife from that all-too-frequent defrosting. How does it do it?

There are only two things you really need to know here. One is that it involves some heater coils in the refrigerator's walls, and, two, it takes as much (if not more) electricity to perform this job as it does to run the motor-compressor. This is why frost-free refrigerators, in normal operation, consume 2-3 times as much electricity as refrigerators of the equivalent size consume *without* this feature.

Defeating this circuit *seemed* like a relatively straight-forward process to me. I unplugged the refrigerator, removed the back plate, disconnected the wires leading to the frost-free heater coils (noted by the handy schematic inside the back cover), replaced the plate, and plugged the refrigerator back in again. All better, yes? For five minutes maybe. Then it stopped cold. Or, more appropriately, stopped making cold. The frost-free circuit, in that refrigerator, was integral to the design and components used in the frost-free refrigerator. So, my advice is: don't fool with it. A working frost-free refrigerator has more trade-in value than one that isn't working. And that's what you want to do—trade it in. Make certain that the new one has no such feature. In the end, you use less energy at the cost of fitting an occasional defrosting into your lifestyle.

11. Insulate the refrigerator. The refrigerator is insulated from the environment. In truth, no matter how thick the insulation is, heat will pass through it, get inside, activate the thermostat and coolworks, and get pumped back out. However, the thicker the insulation, the harder it is for heat to get in and the less the refrigerator's motor-compressor has to run. Ergo, the less energy it uses.

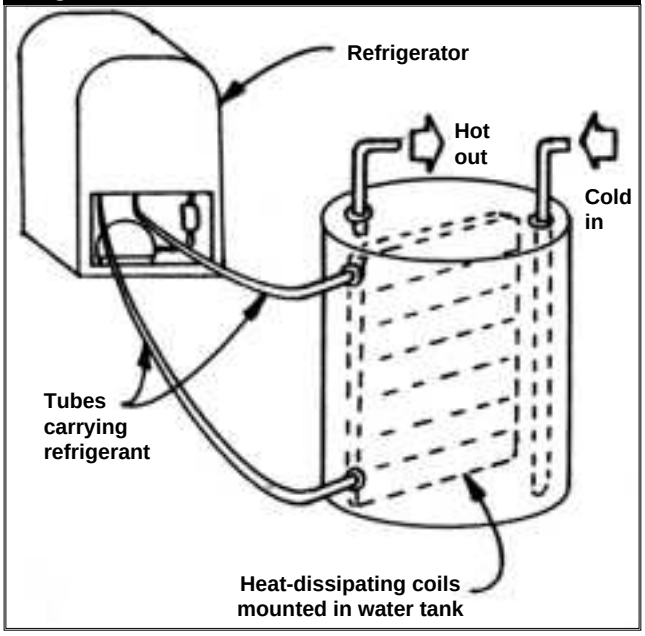
Just how much insulation should the refrigerator have? Without getting absurd, as much as we can afford—in terms of space or money. The manufacturer's answer to this question? As little as they can get away with. Don't be too hard on them, however. A bulky refrigerator doesn't have as much sales appeal as a slim-and-trim one. Any amount of insulation you're able (or willing) to add will make, on its own, a very significant contribution to the refrigerator's efficiency. Here's an idea, then, that has an excellent cost-benefit ratio.

If space around the refrigerator isn't a restriction, you can use just about any type of commercial insulating material you desire. If you're cramped for space, your best bet may be polyurethane foam sheeting; it has the highest R-value (resistance-to-heat-transfer rating) per inch of material thickness. A 2-inch thick "jacket" will give you an R-11 insulating value. If you can double it, you're up to R-22. The bottom, sides, and top of the refrigerator lend themselves very well to insulating in this manner. If you're concerned about appearance, consider covering the foam with some wood-faced paneling or rough-sawn siding that is stained and sealed to match your kitchen decor.

Insulating the refrigerator door may be a problem if it's contoured, as many are. If you can accept the challenge, cut the foam sheet to fit and attach it. Since the door is movable, the insulation must be, too. Be certain, therefore, that it will move freely for as far as the door must swing. Since there are normally no refrigerant-carrying tubes or electrical wires in the door, sheet-metal screws may be used to secure the insulated cover. Check! If there's a light in the door or an ice-making tray, don't risk it. Or, if it's a hassle, don't bother. Refrigerator doors usually have more insulation than the side walls or bottom anyway.

Construction-grade sheets of rigid polyurethane insulation are available at local lumber, building material, and hobby supply firms. Alternative insu-

Figure 3: HDC in water tank



The heat-dissipating coils (HDC) may be mounted in a tank of water.

lating materials are also available. If it's foam, check around for the best buy, however; prices vary from place to place. If you plan to cover the foam with paneling, cut the foam to size and tape it at the corners. There's a temptation to use sheet-metal screws to hold it to the thin metal walls of the refrigerator but you should, at all cost, refrain from drilling holes into the exterior walls. While the thin tubes carrying the refrigerant are spaced pretty far apart and the probability of hitting one is quite small, how unlucky can you afford to be.

Think of this insulation as a 'jacket," meaning removable, if need be, in order to move or service the refrigerator. Caution: Unless you perform a modification of the refrigerator which involves the removal of the HDC (heat-dissipating coils—see #12 below) and/or the motor-compressor unit (#17 or #18 below) from the immediate vicinity of the refrigerator body, you must *not* place insulation in such a way as to interfere with the free-flowing movement of air to, from, and around these components.

12. Re-locate the HDC (heat-dissipating coils). Traditionally, the HDC are mounted behind the refrigerator, within an inch or two of the back wall. Considering the minimal amount of insulation that's crammed into the refrigerator wall, and the kind of heat the HDC can generate, this is downright irresponsible! Coupled with the problems of getting sufficient cooling air to the HDC and an almost certain interference with adding insulation to the back of the refrigerator (where it needs it the most), it makes a lot of sense to remove and altogether relocate the HDC.

Sounds formidable, doesn't it? However, after some initial investigation, I discovered that physically separating the heat-dissipating coils from the refrigerator housing wasn't all that involved. In fact, it's done all the time. Supermarkets routinely install the motor-compressor and HDC on top, or at the rear, of the building. Refrigerant tubing runs from these units to the freezer or refrigerated-air, food-display cases inside. It's a toss-up whether you really *need* to also separate the motor-compressor, as it's usually not all that noisy, nor does it generate that much heat. But I was advised by a refrigeration friend to keep it in close proximity to the HDC, if possible.

The actual changeover is easily accomplished if you've any handyman skills. If worse comes to worse, you can get the local refrigeration technician to do the job for you. Get a quote first; it may not be worth a couple of hundred dollars to you. And even if you do most of the work—disconnecting the motor-compressor and HDC, re-locating it, and running new refrigerant lines, etc.—you'll eventually require the services of a refrigeration technician to inspect the work, bleed the lines of air, and recharge them with the appropriate refrigerant.

All refrigeration technicians can get a system functional, but only a few can get it operating efficiently. Additional tubing lengths may require a different charge—a fine tuning—to make the changeover worthwhile. Ask the technician if he can do this. It's important.

If you move the HDC, you can now locate the refrigerator (box) inside the house, pantry, or root cellar without the normal concern for the heat the unit will give off. It won't generate any. Another major benefit of this modification is that it permits trouble-free recessing of the refrigerator in flush-fitting alcoves.

The HDC (and associated "coolworks") should be mounted outside, perhaps, on the shady side of the house. Protect it from the elements—rain, snow, etc.—and the fingers of curious children. Additionally, if you live in cold climes and there's *any* chance that the outside temperature will fall *below* the inside temperature of the refrigerator, you should "shelter" the motor-compressor and HDC from air currents. Apparently, this condition confuses the heat pump and refrigeration may stop. Removing the fan blade from the compressor pulley (if it exists) also works. Just don't forget to replace it when the cold snap is over.

13. Build a hybrid refrigerator/water heater. What's that? It's a refrigerator which has had its HDC removed and placed in a tank of water. Why would we want to do that? Answer another question first. What are two ways to tell if a refrigerator is working correctly? First, put your hand inside; feel all that cold? And, second, snake your hand around the back of the refrigerator and feel the heat-dissipating coils. Hot, aren't they? We don't get one without the other in a heat pump. Just as its name implies, a heat pump moves heat from one place to another. But it sure is a shame to waste that heat, right? So why not put it to work?

Answer another question. Year-round, what's the one thing in the standard household that might make use of this relatively low-level (but constant) heat source? The water heater, of course!

And what happens when you put the HDC in a tank of water? Naturally, the water gets heated. So how about a refrigerator that also works as a water heater. Right away, you'll run into a problem when you try to interface a stock HDC in a water heater: the HDC is way too big. My first reaction to this dilemma was to reverse the situation. That is, size the tank to the HDC. I used a 55-gallon drum. However, at 30 psi water pressure (a gravity system, at that), the barrel bloated up like a lungfish and damn near gave me cardiac arrest. I thought it was going to explode.

I cautiously tried it the other way—sizing the HDC to the water tank, and this worked much better. Since water is so much faster than air at conducting away the heat, only a portion of the HDC's original area was needed. Quick work with a hack-

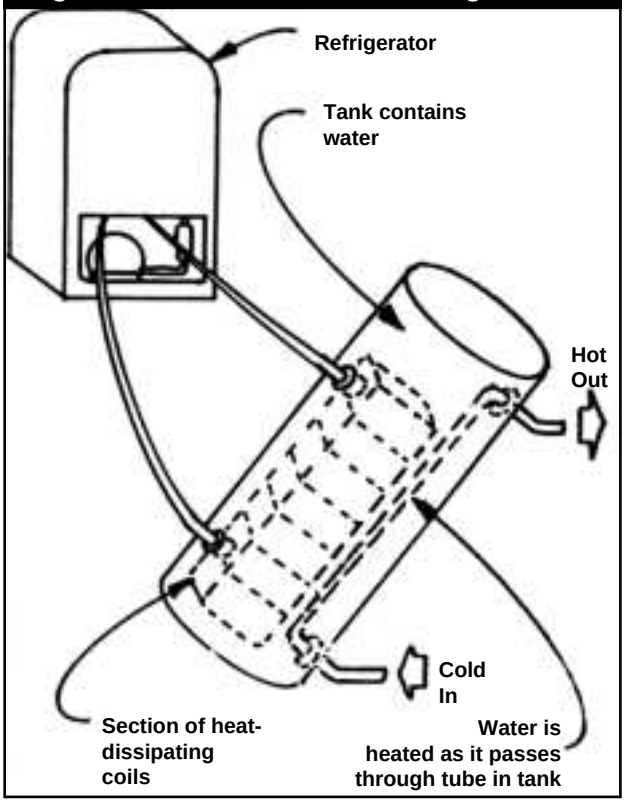
saw reduced the HDC to a long, narrow section which easily fit inside a steel tank that, hereafter, was to be a water heater (see Fig. 3).

After hearing of my modification, a refrigeration technician recommended what he thought would be a simpler process for most people. Add a small length of tubing between the compressor and HDC and insert this into the tank. Since this is the "hottest" portion of the line, it accomplishes the same end while eliminating the "chop and fit" on the HDC. I wish I'd heard that *before* I did mine.

Why didn't I just install the smaller section of HDC in the water heater tank I was presently using? Well, besides some rudimentary problems associated with doing it *without* damaging or destroying the water heater, there's another very important reason *not* to do this. Those heat-dissipating coils are, in fact, circulating refrigerant. Older units may still use ammonia and newer ones have Freon. In the event of a leak, they'd end up in your water. Unpleasant, at least; dangerous, at best. Since there is no simple way to prevent a tube from leaking the stuff into your water tank, use what's called a "double heat-exchanger" (See Fig. 4). That is, the heat-dissipating coils go into a tank filled with water and *another* coil of tubing connects directly to your hot water line. The water in the tank, then, stores the heat, transferring it to the water circulating through the coiled tubing when you want to use some. It's a lot simpler than it sounds.

There's one major condition attached to the hybrid refrigerator; you must use the hot water that's produced. When the water in the tank is its coolest, the refrigerator is operating at good efficiency. This efficiency decreases as the water temperature increases. So, for some function or another, *use* that heated water.

Figure 4: Double-heat exchanger



A double-heat exchanger is a safer installation.

Want some facts and figures? A medium-sized refrigerator will have a rating around 2,000 Btu/hour. At a duty cycle of 30%, this amounts to a steady 750 Btu pumped away as waste each hour or, in a 24-hour period, some 18,000 Btu. If the water in the tank housing the HDC is initially at 60 degrees F, we'd need 480 Btu for each gallon of water raised to the temperature of 120 degrees F. Assuming only 50% efficiency, we'd get 15-20 gallons of hot water each day. That's peanuts to some folks and blessing to others. What about you?

Hotter water *is* possible, but I'd advise against anything more than 105-120 degrees F. Otherwise, the refrigerator will be working nearly as hard as it would *without* the hybrid setup. Remember our goal: use the waste heat *and* cut down on the electricity consumed by the refrigerator.

Is the hybrid refrigerator/water heater worth the effort? For a conversion, I'd say no. There's too much involved; too many "if's." For special applications and investment in future technologies, yes! The refrigerator/water heater symbiosis is a natural technology, transferring heat from an unwanted place to a welcome one. It uses heat that's otherwise wasted and, in the process, saves the energy—electric, gas, wood, solar, etc.—consumed in water heating. Also, the efficiency of the refrigerator can increase dramatically, as water conducts heat away from the HDC faster than air. This boosts a further savings in electricity since the motor-compressor unit runs for a shorter period of time.

14. Use a horizontal refrigerator rather than a vertical one. This technique is used with chest-type and open supermarket freezers. Just as warmed air will rise, cooled air falls. And *very* cold air sinks like a rock. True, if there's any kind of air movement, some of this cold air is going to "slop" out onto the floor and even absorb some of the warmer air above the freezer-case. But "horizontal" cooling works well. The same cannot be said for vertical coolers—the ones traditionally containing milk, pop, beer, etc., enclosed by sliding glass doors. Open them and cold air spills out in huge amounts. Just like with vertical refrigerators.

Why, then, are refrigerators built with vertical doors? Two basic rationales have prevailed: electricity is dirt cheap and wasting energy for convenience is okay.

An upright refrigerator is not as easily converted to work in a horizontal position. You can't just turn your own refrigerator over on its back. First, it would soon stop working. And, how would you place food in it. I no longer

recommend converting an upright refrigerator to a horizontal position. Too many variables and too much work for an uncertain product.

If you're ready to go this far, and can't purchase what you want, opt to build the refrigerator from scratch. This is frequently done in marine environments where the shape of a sailing ship's hull will not accommodate a box-like shape. Instead, the refrigerator's coolworks are built around a low-voltage compressor unit and a holdover plate that can be "pumped down" (made cold) inside an odd-shaped, well-insulated compartment. If the access door is on top, so much the better.

People complain about difficulties in accessing food in chest-type freezers. Resolve this issue in some way that is acceptable by everyone using it. Several lightweight trays that will hold frequently-used goods can be lifted out—in the same way many toolboxes are designed—for access to lower levels of foodstuffs.

Power conversion (electric)

The standard household refrigerator in the United States is designed to operate at the 110-Volt, 60-cycle AC (alternating current) supplied by the local utility company. Obviously, if you're not using utility electricity, the "stock" refrigerator isn't going to work "as is" with DC (direct current, as from batteries) at lower Voltages. What do you do? You either match the system to the refrigerator, or the refrigerator to the system. Here are a variety of possibilities.

15. Use a 110-Volt AC standby generator. Auxiliary generator units—small gas engines driving AC generators—exist for use in areas remote from utility power. Or as a backup unit whenever utility power is interrupted. Or as *the* energy source in a survival situation. Portable units, ranging in power from 1,000-6,000 watts (and higher) supply precisely the right kind of electricity needed by the standard refrigerator, eliminating any need for modification. The only pre-requisite is that the standby generator have a power rating equal to, or greater than, the refrigerator's rating.

This idea has some justification; it may take time to set up another way of powering a refrigerator and this keeps things cool in the interim. It's also great for emergencies since you're likely to require a standby generator for special power applications, i.e., radial arm saws, arc welders, etc.

Unfortunately, while the parts work well together, as a system the idea stinks. Powering a refrigerator on a continuous basis from a standby generator has little merit. A unit sized large enough to handle power tools would waste gas powering a refrigerator. Also, refrigerators are basically "demand" devices, operating intermittently throughout the day, adjusting themselves to varying food loads, external temperature variation, and operator mis-use. A once-a-day "charge" of refrigeration from a standby generator isn't going to help food stay fresh, and staggered use of the standby generator throughout the day for refrigeration alone will be a short-lived solution.

Contrary to popular opinion, standby generators are complex. Most folks don't possess the skills or knowledge to keep them on-line even if they *do* have the money to buy all the necessary spare parts. They are noisy. They are as unwelcome as mosquitoes. Mufflers will help, but they reduce—not eliminate—the noise. Also, the more effective the muffler, the more inefficiently the engine operates and, alas, the more fuel consumed per kWh of electricity.

A standby generator *does* have its place in every homestead. However, the inherent mismatch between it and the standard refrigerator (specifically) and most other electricity-consuming devices (generally) relegates its role to backing up *other*, renewable energy sources like PV (photovoltaic), wind generators, and small-scale hydroelectric units.

16. Use an inverter. An inverter is a device which transforms DC (direct current, like that supplied from batteries) into 110-Volt, 60-cycle AC (alternating current, like that supplied from the utility company or standby generators). This *is* convenient; we can match a battery system to a stock refrigerator. Additionally, inverter manufacturers make models for a wide range of DC voltages. You can get a unit to work with 12-, 24-. 32-, or 110-Volt (DC) battery arrays. It's a quick fix for anyone who has battery power (smart) and a 110-Volt AC refrigerator (convenient), but lacks the time to mess around with other alternatives.

As with any "fix," there's a price-tag. The inverter does nothing to reduce the amount of electricity consumed in refrigeration. Instead, a portion of the inverter's output must be reserved for the refrigerator. Of course, it is possible to "schedule" the time the inverter is used to power the refrigerator. This inverter is special, too; only inverters designed to handle inductive (reactive) loads can be used with refrigerators. As well, the inverter must have a load-sensing feature. Without it, it will be "on" and drawing some power even when the refrigerator is "off." Finally, inverters of whatever type—rotary, electronic, etc.—are complex mechanisms. They're *not* consumer serviceable. Consequently, the final system is no longer simple nor inexpensive. Inverters which can power a refrigerator may cost 1-3 times the cost of the refrigerator itself.

But, once an owner/user evaluates the cost of that proportion of solar array, and battery and inverter capacity devoted to a 110Vac, 60-cycle refrigerator over the long term, the cost of a low-voltage, high-efficiency refrigerator (see #24 below) doesn't seem so high.

17. Modify the motor-compressor unit. If the power source is batteries—at 12-, 24-, 32-, or 110-Volts DC—one of the best ways to match them to a refrigerator is to remove the AC motor that drives the compressor and replace it with one of the correct DC Voltage. This is a difficult undertaking if the motor and compressor are "hermetically sealed" (built as one unit - see #18 below), but older refrigerators have a motor separated from the compressor by a belt (and pulley) or a star-coupler. If this is the case, the entire assembly should be removed from behind (and underneath) the refrigerator. Next, remove the AC motor and pull the fan blade off its shaft.

Select the DC motor carefully. It must generally match the old motor's HP (horsepower) and RPM (revolutions per minute) ratings. DC motors have conservative ratings when compared with AC motors. For this reason, you may select a DC motor which has a HP rating ¼th to 1/3rd smaller than the AC motor you pull off. Look for a HP tag on the AC motor. No luck? Find the motor's wattage rating. Or multiply the Amp (A) rating by the voltage (Volts, or V) rating of the refrigerator. The resultant is wattage which, when divided by the value 750, will give an approximate HP rating. This value is usually less than 1 horsepower, and as long as ¼ HP.

Small variations in motor RPM ratings—between the old AC motor and the new DC motor—aren't significant. If the values are close, bolt it up. Larger variations in RPM ratings must be adjusted. Vary the ratio of pulleys in the belt-drive to achieve a match. If a star-coupler was originally used, either go to a pulley drive (and match RPM with the correct ratio of pulleys) or find a motor of correct RPM rating.

Other factors? Change the light bulb in the interior to one of the correct Voltage. Change the motor relay to its DC equivalent (see Fig. 5). Leave the old thermostat alone. It should work fine. Now's a good time to think about sticking the motor-compressor unit, along with the HDC (see #12 above) elsewhere (outside?). You may not have a choice. The modified motor-compressor unit may not fit back into its original refrigerator space. If you've cut the refrigerant lines, reconnect the lines and re-charge them with new refrigerant (or have this done). Finally, insulate the refrigerator in the area once occupied by the motor-compressor unit.

18. Replace the motor-compressor unit with another that matches your system. If the motor-compressor unit is the "sealed" type (where the motor and compressor are an integral, non-separable part), replace it.

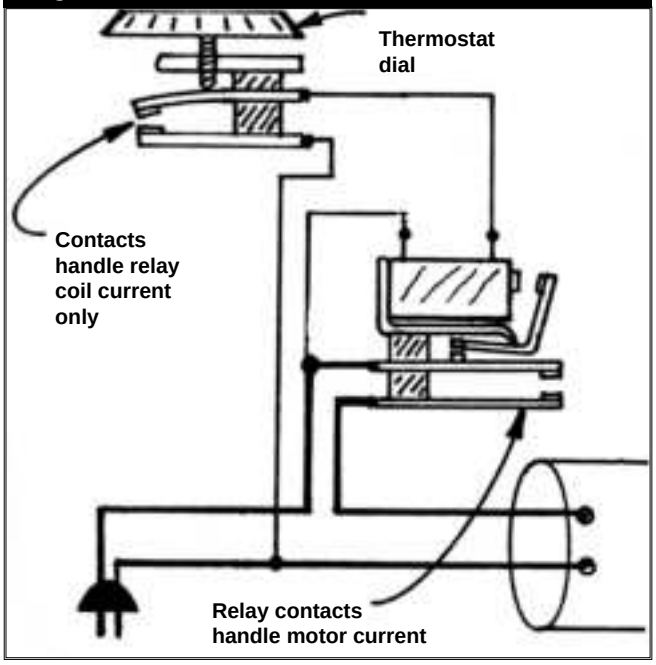
There are two ways to proceed. One is to scout around for a motor-compressor unit of equivalent rating which *is* separable, buy it, strip off its motor, and add one with the correct DC voltage. Get some help. A refrigeration technician will be of great assistance. Plus he or she may have a junked unit of precisely this type out in back. If the only thing wrong is a burned-out motor, what could be better? And, if you affect energy-saving modifications with your refrigerator, you may look for a motor-compressor of a *lesser* rating. That is, when you do it better, you don't need a unit designed to compensate for all of those losses.

A second possibility is to replace your refrigerator's motor-compressor unit with one designed specifically to work at lower DC voltages. For example, 12-volt motor-compressor units exist in the RV (recreational vehicle) and PV (photovoltaic) industry. Or check out surplus outlets. A 24-volt system can make use of a military 28-volt motor-compressor. Folks using 32-volt systems, on the other hand, should check marine and railroad supply houses; many boats and trains still use this standard DC voltage. And 110-volt DC equipment (i.e., a universal motor) is readily available through many farm equipment and surplus sources.

The other components—light bulb, power relay, thermostat, etc.—in the refrigerator get the same treatment as those where a refrigerator's motor compressor unit is only modified (see #17 above).

19. Power the refrigerator with a battery charger. Once a refrigerator has been converted to low-voltage DC operation (or if it's originally designed that way), it is ready to use the energy of the sun, wind, and water all around us. Another source of energy is the battery charger—whether it is plugged

Figure 5: Thermostat control



A standard thermostat can control a relay to handle any load or motor.

into the utility grid or a standby generator. A battery charger transforms 110-volt, 60-cycle AC into lower DC voltages. This is handy in an emergency.

There are two prerequisites of a battery charger for this job—the correct (final) DC voltage and a wattage rating (the product of the output voltage and output amperage) equivalent to, or greater than, the refrigerator's power rating.

Power conversion (gas)

Servel-type (gas) refrigerators are designed to accomplish refrigeration with a small gas flame as the power source. Naturally, these operate on a principle that's very different than ones equipped with a motor-compressor unit. The fuel that is used also varies. Natural gas, propane, and butane are commonplace fuels, while an occasional kerosene-fueled unit may be found.

While refrigerators based on liquified fuel are dependent on oil supply and economy, they can be a real blessing for remote sites. Add in the advantage of a high-density fuel (and a 300-gallon propane tank) and you have an attractive alternative to the electric refrigerator.

Gas refrigerators don't lend themselves very well to relocation of their heat-dissipating coils, upright-to-horizontal conversions, or hybrid (refrigerator/water heater) adaptations. This is due, in part, to the sheer number and complexity of components in the gas refrigerator. However, the owner of a gas refrigerator is not altogether restricted. After all, there are other sources of heat than a flame.

Note: The three conversions suggested in this section apply specifically to Servel refrigerators, with which the author has experience. Other makes of gas refrigerators will make use of the same principles described herein, but specific component parts and processes will vary. A copy of the master Servel Service Manual, which covers all models, is available for $10 from me at Box 327, Willits, CA 95490.

20. Convert the unit to the correct fuel. Since a stock Servel-type refrigerator can utilize any one of three fuels—natural gas, propane, or butane—with the change of only a few small parts, you must consider the possibility that the unit you own is *not* set up for the gas you intend to use.

If your unit operates poorly or not at all, this is immediately suspect. However, the BTU differences between these fuels can be slight enough that you could operate the refrigerator on the wrong gas and never know it. Using the wrong parts, the refrigerator will run too rich or lean, waste gas, and force more frequent refills.

How can you tell if the unit does need conversion? Easy. Conversion involves three things: the orifice (jet), the turbulator, and an adjustment (maybe). The first thing you do is locate and remove the burner assembly from the refrigerator. Next, find the jet (that's the orifice in gas lingo), unscrew it, and extract the turbulator.

Does it have one groove or two grooves? One groove is used with LP (liquified propane) and two grooves are used with natural gas (city gas line). So, if you're converting to propane, and you've got a two-groove turbulator, you need a one-groove turbulator.

Since propane is a higher-density fuel (more BTUs per cubic foot) than natural gas, it takes less propane to do the same job. Hence, the burner orifice (jet) must be replaced with one with a smaller diameter (hole). Don't jump to conclusions; even if the correct turbulator is installed, this doesn't mean that the orifice is of the correct size. And vice versa. Check it. It could be expensive (in gas and money) to assume that both were changed at the same time.

Both the turbulator and orifices for the burner assemblies of *all* makes and models of Servel refrigerators are still available. Remarkably, the cost of both parts seldom exceeds $5-8. Obtain them from, or through, your local LP gas office. The Servel Service Manual will prove invaluable here, since the store may not have the cross reference needed to select these components. The manual, then, will help you identify the model you own, and it contains the charts and tables to assist in selecting the correct size of the jet orifice for the fuel you're using. Then, it's a matter of cross-referencing the two.

21. Modify the gas refrigerator for AC or DC operation. The gas flame in the heater box of a Servel refrigerator generates a finite (specific) amount of heat. If you can provide the same amount of heat from any other energy source, the refrigerator will still work. And two convenient sources are 110Vac (utility, generator, or inverter) and 12V DC (batteries, solar modules, mini-hydro, and wind power).

A sealed heat coil is commercially available for use with Servel and other refrigerators (Jeff's Gas Appliance, 549 Central, Willits, CA 95490). It is available for either 110V or 12V electricity and costs about $40. There are several wattage ratings available (depending on model numbers) with the average about 325-375 watts. That's about 3 amps at 110V and about 30 amps at 12V. I didn't know this when I wanted to experiment in "electrifying" my Servel about 25 years ago (see sidebar, Gas-to-Electric Conversion). Hence, I built both coil and control circuitry. [If you buy a 12V heater resistor, you may need a control circuit similar to mine (see Fig. 5). The contacts on most thermostats will not handle the high current at 12VDC.]

The real beauty of this setup—operating a gas refrigerator from electricity— is that it does not interfere with using gas. If you want to use gas again, simply pull out the coil and re-light the pilot. Want to go back to electric? Turn off the pilot and shove

the coil back up into the heater tube. Conversion from one to the other should require only a few minutes. A few extra notes are in order. First, don't be tempted into leaving the electric coil in the heater box during operation with gas. It won't work. Second, during gas operation, exhaust fumes are given off by the flame, and these are channeled through a vent tube to the top of the refrigerator. (The tube will vent into the room unless routed outside.) Electric heat provides *no* exhaust fumes, but the air it warms will rise and carry away some of that precious electric heat. When you use the electric coil, close off this vent. Aluminum foil will do nicely for a cover—squish it down for a tight seal. I'll leave it to you to figure out a foolproof means of installing/removing the cover as you switch from gas to electric, and vice versa.

What if you don't think you have enough electricity to operate a gas refrigerator part time, much less full time, on electricity? I'd recommend, at least, that you buy the parts for the electric heater coil. In an emergency, even if it's only something as simple as running out of propane, you can always power your refrigerator for a while from a car battery or a 110V source.

It's better to have it (or the parts) and not need it than to need it and not have it.

Purchasing a new refrigerator

Thus far, this article assumes that you *have* a refrigerator, that you'll probably want to keep it, and that it may lend itself to the modifications you deem necessary. Nevertheless, an awkward accumulation of design deficiencies in your present unit, an inherent mismatch between available refrigeration and a low-yield energy site, or ownership of a refrigerator that is simply too large for your present needs are all good reasons to consider purchasing a new one.

If you're in the market for a new refrigerator, it's an ideal time to apply the information discussed in foregoing sections. Two goals are worth pursuing. The first is to find a refrigerator which has the *least* number of design deficiencies *you* consider important. And, secondly, get a refrigerator which has design deficiencies that *you* can change. Applying both, item by item, will help match the new unit to your unique situation with the least expenditure of time and energy on your part.

Be forewarned. You may find little "relief" in the purchase of a new, standard refrigerator. Sorry, while there may be more impetus to make energy efficient changes today, there hasn't been in the past. Manufacturers don't pay your utility bills. For this reason, "newer" stuff isn't always "better" stuff. So, if you're led to this section because of the apparent convenience of purchasing anew, instead of reworking your old unit, don't be shocked if you find yourself reconsidering the modification of your present refrigerator. It may look far more attractive after you've looked at the purchasing options.

22. Purchase and modify an old 110-volt refrigerator. A new refrigerator may, in fact, only be another refrigerator. Even if you want to convert it—say, to low-voltage DC—buying a second 110-volt AC refrigerator may be a wise choice.

Why? I can list four reasons. First, you can continue to use the refrigerator you already have. Modification comes under the heading of experimentation and that consumes time and can result in setbacks; both conflict with the everyday need for refrigeration. Second, if your pocketbook is a wee thin, a "standard" refrigerator is a lot less expensive to buy than one which is brand new, or special-built. Three, since you plan to modify the unit anyway, you don't necessarily need a *working* unit. A refrigerator with a burned-out motor-compressor unit is adequate (if you're replacing it anyway) and *always* cheaper than one which is working. And, fourth, since 110-volt AC refrigerators are so commonplace, you've a wider range of models and sizes to choose from. Hence, it's easier to find precisely what you're looking for.

What questions do you want to ask yourself as you search for a suitable unit? Is it in good shape? Will it fit into that special place in your pantry? kitchen? root cellar? Is it a frost-free type? What problems, if any, was it experiencing when it was last used? Is the door warped? Is the gasket okay? Is it the right size (be very critical here)? Are its shelves (they're there, aren't they?) easily removed? Are the "coolworks" easily removed? Can you buy it for less than $10? $15? $20? Be selective.

23. Purchase an RV- or PV-type refrigerator. With the RV (recreational vehicle) boom a few years ago, a new breed of refrigerator was born. Instead of the "scaled down" gas and electric versions found in homes, this new "type" of unit would operate from as many as *three* different energy sources: gas (propane), 110-volts AC (utility power), and 12-volts DC (car battery).

I like the idea of a refrigerator which can use two or more energy sources. However, the actual product is marred by a number of disadvantages. The first is immediately apparent. These things are *small*. Characteristically, only a few cubic feet of space is available. The second problem is that, designed for portability, the units are really compact. Hence, the HDC are positioned in a tangle of plumbing and, in the few units I've seen, it would be a nightmare to remove the coils. A third concern is lifespan. Considering the intended application of the refrigerator—for weekend and vacation use only—I wonder how the unit will hold up in continuous use. Fourth, like station wagons, anything which tries to be two or more things often compromises each one. So, the units tend to be inefficient in any spe-

cific mode. The fifth and final objection is the price. You pay top dollar for the few cubic feet of refrigeration you get.

The booming PV (photovoltaic, or solar cell) industry has also prompted special consideration for efficient refrigeration. Unlike the RV emphasis, refrigerators designed for use in PV systems *must* be efficient because very little power is available. For example, a 17-cubic foot SunFrost consumes less than 0.5 kWh per day on 12VDC. The price of the unit *seems* high—around $1,200-1,500 depending on size. However, when you consider that this unit would take two *years* to consume the energy used by a standard refrigerator in one *month*, it's worth a second glance.

It's hard to imagine shelling out more than a thousand dollars for a refrigerator, isn't it? Still, the cost/benefit ratio of this new breed of refrigerators is quite good. (Sun Frost, P.O. Box 1101, Arcata, CA 95518. Tel: (707) 822-9095)

For anyone able and willing to make their own, well-insulated refrigerator enclosure (as in sailboats), consider purchasing the "coolworks" for one of these super-efficient refrigerators.

24. Find and buy a Servel (or other brand of gas) refrigerator. There are a lot of old gas refrigerators out there, folks. Since electric is still the rage, they're fairly inexpensive to buy. If you only wish to use them on gas, fine. Later, you might consider an electric options (see #21 above).

The biggest problem with buying a Servel is finding one that's in operating condition. Since most are stored in a barn or lying out in the weeds out back somewhere, you can't be sure they'll work until you get them home and hook them up. Sure, the pricetag may be very low. Nevertheless, buying $25 worth of junk is still a net loss of $25. And, since there are a *wide* range of models and sizes (I've yet to see two that were identical), don't count on using a dud for parts.

However, Servel refrigerators may still be found in good condition. Why? Because they were often replaced with electric equivalents *before* they wore out. This is also the reason why they weren't simply hauled off to the dump. So, despite their vintage, they're fairly easy to find. Running an ad is one way to find them. If you're lucky, the local refrigerator man in rural areas is likely to sell and service them, or know where some are. Look it over closely (see the sidebar, Inspecting a Servel Refrigerator) to weed out the poor candidates.

A final comment. Servel refrigerators are neat old "horses," but if you seriously don't need a gas option in a refrigerator, stay away from them. There are many modifications—relocation of the HDC, hybrid refrigerator/water heater, conversion from upright to horizontal orientation, all-around insulation, etc.—that are impossible to perform on them. If these are important to you, look at other options.

25. Build your own refrigerator using a solid-state module. An exciting newcomer to the refrigeration field is the thermoelectric cooling module. Unlike the electric or propane-based refrigerators, this does it all with transistors. No kidding! Only it's just one big, special transistor. And when you apply electricity to it, something amazing happens —one side of the module gets hot and the other side gets cold. It's a heat pump which employs the principle of the Peltier effect. You've got to see it to believe it.

The Peltier module is used in battery-powered coolers at 6 or 12 Volts DC. Power consumption is less than 50 watts. The efficiency is low—about 10-15%—about the same as PV modules. Polarity is important; if the leads are reversed, the unit will cool and heat on (respectively) opposite sides. Some models come complete with a ther-

Gas-to-electric conversion

Many years ago, I fabricated my own electric-option for my Servel. First, I wound a length of nichrome wire around an insulator. I used an old porcelain through-wall (electrical wire) insulator; this supports the nichrome wire, safely dissipates its heat, and allows one of the power leads to be run *through* the coil. Next, electrical wire power leads of an appropriate length were added. I screwed them on. I figured soldered connections would melt with the heat.

Before I installed the electric coil, I rolled a thin section of mica insulator sheet into a tube shape, and inserted it up the heater tube (in the refrigerator) in the portion normally exposed to the gas flame. Since the heater tube is metal, I wanted the mica to keep the nichrome wire from contacting and, thereby, shorting out against the tube wall. I was aware that I would interfere with heat transfer. Next, I inserted the heater coil and bent the trailing wires to help support it.

This worked but I am happy to shell out the 38 bucks for a sealed, ready-to-go heater coil that was designed for this job!

The electric heater coil may be controlled by a simple switch. Turn it on when you want refrigeration and off when everything's cold. It is possible to size the coil's wattage rating for a continuous "on," but since a refrigerator's cooling needs fluctuate considerably through any given 24-hour period, the food will alternately freeze or thaw. During gas operation, I observed that my Servel gas refrigerator was "on" an average of 20 minutes per hour, or *less*. I was unwilling to babysit my refrigerator.

Unfortunately, the thermostat already installed in the unit was designed for gas and not electric operation.

Fortunately, there is a solution. Install a standard thermostat (like those found in electric refrigerators) in your gas model and have it operate a power relay for heater coil operation (see Fig. 5). The power relay should have an efficient coil resistance for the voltage. Also, its contacts must be able to handle the DC current.

Inspecting a Servel refrigerator

When you have found an old Servel refrigerator, it's time for a closer look. Is it all there? It should have a door with a working latch and a decent gasket, trays, gas line, burner assembly, backplate, and thermostat. After you've looked at the innards and *before* you go any further, ask yourself if this unit is of the right size (capacity). If not-it's too big or too small-don't tempt yourself any further; walk away and search elsewhere.

Next, closely examine the back of the Servel, unscrewing and removing the backplates, as necessary. Ammonia is a great refrigerant but it attacks copper. For this reason, the "coolworks" will use cast iron or steel pipes and fittings. The point? If everything you see is dirty but still painted, chances are that everything's okay. However, if you see lots of rust, this may be trouble.

Unless the unit is connected to a gas line, there's no way you can know if it will still work or not. Even if the owner says it was working when it was disconnected, that does *not* mean that it will work now. I won't tell you what to do at this point; it's your money, so it's your risk. However, you might point this out to the owner; it may help to bring the price down.

Servel refrigerators, even the smaller models, are *very* heavy. A number of strong bodies and a heavy-duty handcart are indispensable when it comes to moving a purchased unit onto a truck bed. Always tape the door shut, as even a working latch can be snagged and the door can open at an inconvenient (or dangerous) moment. If it doesn't whack someone, it will probably damage itself. Also, only jack the refrigerator from the sides, *never* from the front or back. If you can't safely tie it off (in the truck) in an upright position, lay it down on its side. Some old rug parts, blankets, even a sheet will help as it's lifted or pushed onto, or out of, a truckbed. Strap it down tight and drive slowly. Treat it as you would a rare player piano.

Once you've got it home, clean it up, locate the burner assembly, disassemble the jet, and determine whether or not it will require conversion to the gas you intend to use (see#20 above). Can't figure out where the burner assembly is? Get a service manual.

Many a Servel unit has been hauled off to the junkyard after a revival attempt has "failed" simply because the unit was not burped. Yeah, you read it right. Just like a baby-BURPED! In disuse, an ammonia bubble can get trapped in some part of the plumbing and, when re-activated, fail to dislodge. This will prevent cooling.

How do you burp a Servel? Just like a baby, of course. Well, after you've removed the trays and other loose parts, and taped the door shut. Next, lay the refrigerator on its side, and roll it up onto its top, *carefully*. A complete roll to the other side is fine if room permits, but, while it's upside down, thump it, rock it, and jar it. Work that bubble loose. Of course, if the unit has other problems, this won't help. More often than not, however, this *is* the problem and the refrigerator will work after burping it. Folks who laugh at this procedure, claiming their units didn't have the problem, don't realize they may have inadvertently "burped" their unit transporting it over the bumpy road to their place.

mostat for unattended operation; others don't, necessitating manual on-and-off switching.

Correctly applied, each module is capable of freezing up to two cubic feet of space or providing normal refrigeration up to four cubic feet. If greater cooling capacity is needed, additional modules may be "ganged" (paralleled) together. In fact, the 12-volt model is really two 6-volt modules in series. More cooling is available from extra modules but the power consumption also increases proportionally. It's the pricetag, at $150-200 per module, and low efficiency that will prevent widespread use.

The Peltier module was interesting to me when I was looking for a way to piggyback (or hybrid) a refrigerator with a water heater (see sidebar, A hybrid refrigerator/water heater, and Fig. 6). Since water conducts heat away more about a 150 times faster than air, the module's shape is ideal for interfacing the heater and the cooler on which it is stacked. I figured the module's efficiency would be at optimum and the heat normally wasted recovered for a practical use.

The main obstacle in using sold-state modules for refrigeration is finding a source for them. Contact a company which sells the picnic-type units like Koolatron; they may sell the modules separately. In the proper environment—good insulation, small container capacity, essential cooling needs, and a knowledgeable operator—the thermoelectric cooling module is a technology searching for an application.

Refrigeration alternatives

I have gotten so caught up in the various ways of perfecting refrigeration that I have failed to realize that one of the best schemes is to reduce the *need* for it by pursuing alternatives. Anybody who uses a refrigerator seldom considers what mankind did *before* the refrigerator

was developed. Some may remember cutting ice from lakes, storing it in well-insulated buildings, and the daily task of transferring small chunks to the "icebox" in the house. But let's go back still further in time.

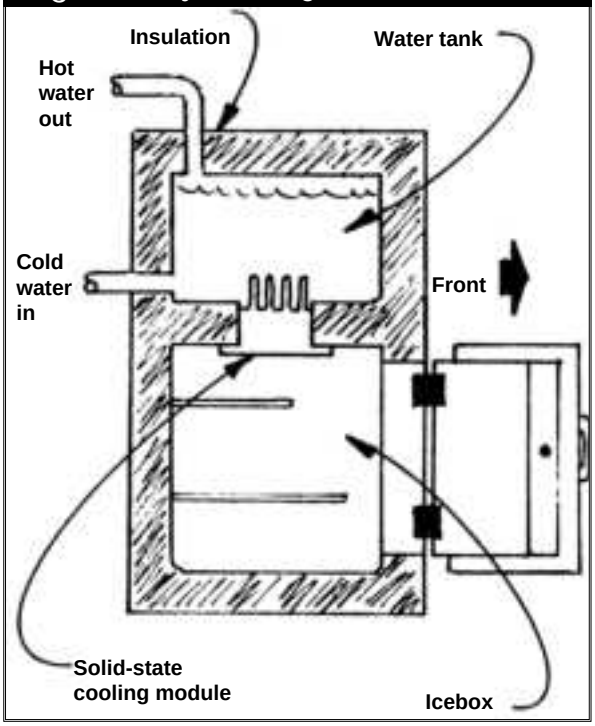
In the pre-icebox era, how *was* food preserved? Basically, people used one or more of four techniques: root-cellaring, canning, dehydration, or controlled supply. Let's look at them one at a time.

26. Build and use a root cellar. The secret to the root cellar is that it's tucked down into the midst of the biggest thermal flywheel we know—the earth. In a 12-hour span, air temperatures may vary as much as 100 degrees F above ground. Several feet into the earth, however, there may not occur a one-degree change. Season to season, the same in-earth spot may vary by only 10-20 degrees F.

Traditionally, root cellars are built under the house. This provides easy access and cuts down on the cost of separate construction. Another important aspect of this design is that the house itself acts as a buffer against surface-side temperature fluctuations. One built separately from a house must be snuggled down a little further in the ground to avoid the influence of temperature variations at the cellar's weakest boundary—it's ceiling and entrance.

What kinds of food can be stored in a root cellar? Garden produce and grains. Vegetables have a natural protection against weather and, when ripe, may be kept for exceptionally long periods merely by keeping them cool. Most types of grain—stored in air-tight, air-evacuated (vacuum or gas-filled) containers, and kept from temperature extremes and direct sunlight—will keep almost indefinitely. It may appear that a root cellar's main function is to protect food from the ravages of summer heat, but this isn't true. Vegetables are just as susceptible to damage by severe cold or freezing. So, the root cellar's moderating influence is also essential during winter months.

Figure 6: Hybrid refrigerator/water heater



A hybrid refrigerator/water heater built around a solid-state module.

Grain and vegetables constitute less than 50% of the average person's daily diet. Also, the root cellar may prove inadequate in light of the cooler temperatures required to preserve other foods—dairy and poultry products, meats, and frozen vegetables. Nevertheless, the root cellar keeps vegetables and grains out of the refrigerator and, in the process, cuts down the size of a unit needed to handle perishables.

27. Learn canning for foodstuffs. Canning involves all types of foods but focuses principally on fruits and vegetables; preserves, pickles, jams and jellies are the end product. However, meat, poultry, and seafood can also be canned. Canning requires no energy in storing the finished product, but it will require a strong heat source and the energy of your own labor to prepare. By comparison, freezing foods predominates now for its obvious advantage in convenience, but its main disadvantage is high energy consumption for the duration of the storage.

Improper processing when canning produces a toxin which causes botulism poisoning. It's the fear of this possibility which turns prospective canners away from this food preservation technique. This is both unreasonable and unfortunate. When tried-and-proven recipes are used and other processes are followed for jar preparation, there is no danger. *Backwoods Home Magazine* has had a number of articles on canning in past issues.

28. Dehydrate your food. Another food preservation technique is dehydration. Involving low-temperature heat, freezing temperatures, or vacuum, this process drives water from foods. As a result, the final product is sealed against the normal pace of decomposition. The final product can be eaten "as is," or reconstituted with water.

The most widely-known example of food dehydration is beef jerky. Although the process is carried out in gas or electric ovens nowadays, the original version involved stretching the thin strips of meat out on sun-baked rocks. In addition to the preparation, the cook had to stick around to fend off animals, birds, flies, and other insects lured by the delicious scent.

A person serious about using this food preservation technique could easily build a solar dryer for unattended drying of bulk quantities of fruit, produce, and meat. The popularity and high cost of dried fruits and meats should be indication enough of what you could do with any surplus dried foods from this inexpensive process.

A hybrid refrigerator/water heater

The thermo-electric cooling module (based on the Peltier effect) is capable of keeping a small, well-insulated compartment 408F below ambient-air temperature. However, touch the "hot" side of the unit after it's been in operation for a while, and you can get burned. Why is the metal hotter than the air temperature? Even with the cooling fan, it's just time for the heat to leave the radiating fins. But, if you piggyback this module-its hot side-into a water tank (after removing the fan and other hardware) things get better (see Fig. 6). Why? Water conducts heat away nearly 150 times faster than air.

In this design, the refrigerator is at the lowest point, the water heater at the highest, and the module is inserted in a hole between them. When switched on, the module "conducts" heat from the lower side to the upper side. In the refrigerator, the cooled air falls and the (relatively) warmer air rises to be conducted out of the refrigerated space. In the tank above, the water in contact with the module will be heated and rise, allowing cooler water to rush downward and, in turn, be heated.

The module iis only capable of conducting a small number of BTUs per hour. In this application, its performance will be significantly better, yet probably not double that of air transfer. Deep insulation, particularly at the cold box/water heater junction, minimizes losses. The rate of energy transfer between refrigerator and water tank may be increased by adding more modules.

The "hot" face of the thermoelectric module is aluminum. After an indeterminate time with exposure to water, it will corrode and may become plated with minerals in the water it heats. For this reason, provide access to the modules for periodic cleaning and make use of galvanic gizmos to minimize the interaction of dissimilar metals. Since tanks of water heat from the top down, add a thermoswitch to the tank to activate a light or buzzer when the water at the bottom of the tank starts to get warm. In other words, it's time to use that heated water. Shower time.

29. Control and "pace" your food supply. A controlled supply means that you keep your food alive—on the hoof or on the vine—until you're ready to use it. If it's ripe, it's ripe; if it's not eaten or preserved, the food will rot, spoil, or become unpalatable. Therefore, in a controlled supply, one staggers the ripening or aging of food so that it comes due as frequently and as reliably as a trip to the store each week.

Meat supplied from domestic animals is another issue. Unlike the relative freedom we may enjoy in picking small or large quantities of vegetables, fruits, or nuts, with animals we're stuck with irreversible "harvests." What portion of it we don't immediately consume *must* be preserved or suffer a loss to spoilage. It wasn't long before raising rabbits for food got to me, and the experience nudged me just that much closer to being a vegetarian. It was the extra effort. When we finally got to the point where there was sufficient food coming from the gardens to maintain our rabbits without the outside purchase of feed, it was also easy to see that we were adding an unnecessary step. In the final analysis, then, the extra energy, water, and grain was too great to justify the meager return.

Last thoughts

A lot of ideas and techniques have been covered in the foregoing sections. While you catch your breath, may I suggest a plan for implementing some of these ideas?

• Seriously consider exactly what it is you want that requires refrigeration.

• Consider one primary and (optionally) one or more secondary power sources for refrigeration. No single source—or the equipment which converts it to useful form—is 100% reliable.

• What conversions, modifications, and replacements appeal to you? Which of these can you perform yourself? Do you have the time, energy, skills, and tools? What will the materials cost? If you need (or want) help, is it available? What will it cost? Is it worth it? Be honest with yourself.

• Are you willing to change some operator habits? Do you need to re-site the refrigerator?

Solid answers to these questions will make other options clearer and, hopefully, subsequent decisions easier to make.

(Michael Hackleman, P.O. Box 327, Willits, CA 95490, is the author of Better Use of Alternative Energy and At Home with Alternative Energy. Currently out of print, both are available at libraries.) Δ

Plant a Y2K Garden

A guide to growing the best crops for coping

By Robert L. Williams

If the Millennium Bug hits hard, one of the best friends you can have is a practical garden. A key consideration in such a garden is which types of produce can be harvested and simply dumped into a root cellar or dark closet, without processing, and left there until needed.

Another consideration, are the types of crops that can be grown in a small area, side-by-side, or among other crops to save space.

Potatoes

Grow Irish potatoes. They are a rich source of complex carbohydrates, one of the essentials of a good diet.

A standard practice of many experienced gardeners is to make potato hills six feet apart in rows spaced six feet apart so they can get their garden tractors and tillers into the space between rows. But if you have a small garden space, this space between plants and rows is not only wasted but a superb breeding ground for weeds and other garden pests. If you grow Irish potatoes, there is no reason for this wasted space as the tubers usually concentrate their growth to a space 18 inches in diameter under the plants.

Between the rows and plants you can grow a variety of other vegetables. If you can spare the space, plant four rows 200 feet long. You can plant two or three eyes in each hill and the hills need not be more than 18 inches apart.

I advise resisting the temptation to grub the new potatoes too early. While these little nuggets are wonderful, remember: for each tiny potato you scratch and eat, you have eliminated the chance for the young spud to triple or quadruple in size within the next few days. Each tiny potato harvested destroys a large one.

When you dig the potatoes, store them in a cool, dry place, such as a good basement. That's all you need do. No canning or freezing or dehydrating is necessary or even recommended. However, if you do not have a good storage space, you can can potatoes in a very easy manner. Because they are non-acid, however, you need to pressure-can them to prevent botulism. And you can, if you

wish, dehydrate or dry them. But once dried, store them in a cool place in sealed containers, otherwise, temperature and humidity will rehydrate the potatoes and cause them to spoil.

Corn

Another good crop is corn. I recommend one of the old-fashioned types that can be used for what we used to call roasting ears. If you have a large garden space, plant an entire field. If you have a small space, plant corn between the Irish potato rows (and you can plant beans along side the potato rows and let the beans climb the cornstalks).

How much should you plant? You will harvest at best two or three ears from each stalk. If there are five adult members of your family, figure three meals of corn per week, so you will need one ear or its equivalent for each diner per meal. That's 15 ears per week, 60 per month, or 720 for a year. That's roughly 300 corn stalks.

Corn can be canned, dried, or frozen. Again, it is not a high-acid vegetable, so you will need to pressure it at a high level for 90 minutes or so. Usually 10 pounds of pressure will suffice, but check your canning books for details.

If you dry it, it will keep on the cob for several months unless it absorbs too much moisture. But remember, mice, rats, and squirrels love it too, so keep it protected.

You can also freeze corn, either as whole ears or as kernels cut off the cobs. But if you have a long power loss, you will need to use the corn quickly or lose it.

Beans

A crop no garden should be without is beans. There are many kinds you can grow, but pinto beans grow well in many parts of the country and they produce bountifully. The more you pick them, the more they seem to grow. You can shell beans and then let them air-dry before storing them in bags, or you can leave them on the plants and they will dry naturally. The problem is that if you don't pick them the plants will stop producing blossoms or will at least slow down.

You can also leave the beans in their shells and dry them. A favorite way for the old-timers to shell pinto beans or peas was to put the unshelled beans or peas into a tow sack, then beat the daylights out of the sack until the dried shells were smashed and the beans were loose.

Another dandy way to dry many kinds of beans was to use a needle and thread and sew them into a long string and stretch the string from one nail to another in a spare room (near the ceiling) and let them dry on the string. Such beans, usually green beans, string beans, or half-runners were called leather-britches.

How many beans should you plant? For the big gardener, I recommend four or five 200-foot rows. Stagger the planting so that all of the beans won't be ready to pick at the same time. Make the plantings two weeks apart and as soon as one row dies out replant it. You can get two or three crops, depending upon where you live.

For the small gardener, plant the beans around the corn stalks in the potato patch. I don't mean dropping a bean between each set of two cornstalks. Plant the beans, particularly the half-runners or other climbing beans in a circle around each of the cornstalks. Let the plants climb the stalks and when it is time to pick the beans you don't have to bend over for agonizing lengths of time.

Another bonus: when the beans are growing off the ground, there is not as much rot or pest damage.

How many beans should you store? A bushel of beans in shells reduces to a small sack of shelled and dried beans, but a cupful of dried beans will expand into a nice potful of beans for a family meal. If I had a family of five, I'd plan to eat dried beans at least three times a week. This means six cupfuls of dried beans per week.

You'd be wise to have at least 25 pounds of dried beans on hand if you plan to be prepared for months of emergency.

If you eat a generous helping of dried beans and another helping of rice you have consumed enough protein to keep your body fit, healthy, energetic, and strong. You do not need any animal protein if you have your regular fix of beans and rice.

Tomatoes

Grow tomatoes. Lots of them. There are few quick meals more satisfying than a tomato sandwich with a plate of beans and an ear of corn. You can can tomatoes easily and you can freeze them. But did you realize that dehydrated tomatoes are wonderful and also easy to prepare?

You can also wrap the tomatoes in newspapers and store them in a cool, dry place. This method of storing works best if you will wait until the very last part of summer and, before the first frost of the season strikes, pick all of the green tomatoes you can find. Pick tomatoes of every shape and size because the frost will destroy any left on the vine.

Inside the house, wrap the green tomatoes, individually, in pieces of newspaper and place them in a box or other stable container and store the box in a closet or under a bed. The root cellar is a great place. They will ripen slowly and uniformly in their wrapping paper and will taste as if they were just picked.

How many tomatoes should you grow? If you have plenty of space, grow 100 plants and can them as fast as they produce. Tomatoes are high-acid and the danger of a botulism problem is minimal. Remember, you can also dehydrate them easily.

If you have little space, you can grow tomatoes in five-gallon cans or in the back corner of the lot. Set them out behind or beside the garage or car port. Grow them alongside the woodshed or utility building. Tomatoes are loaded with nutrients and flavor, and you can use them in a variety of dishes and sauces.

Cucumbers

As space permits, grow tons of cucumbers. These delights will produce wonderfully if they have a fence to climb and grow upon and, if you don't have a fence, you can use the circular wire cages for the same effect. But if you wish, grow them in the corn patch. Let the cucumber vines run along the ground throughout the corn field. The ground cover provided by the cukes will help to hold in the moisture and to keep the weeds down.

Nature had decreed that no two plants are likely to grow in exactly the same space, so since Nature abhors a vacuum, if you do not fill the available ground space with plants, there will be weeds and you must spend a great deal of time hoeing.

Cucumbers will not keep long in a fresh state, but you can make them into pickles of all sorts. And pickles add spice to almost any meal you can serve.

Squash

Grow a dozen hills of acorn or winter squash. These plants produce in large numbers and squash will keep without freezing or canning for months and months.

Regular crookneck or yellow squash provides a quick and bountiful harvest. This squash is wonderful fried, baked, raw, in salads, or in casseroles. You can also dehydrate or can squash with good results.

How much should you grow? If space permits, set out a dozen hills and every two or three weeks start additional hills. You must have ample time to handle the profusion of squash you will harvest. Don't let it go to waste. Can it or dry it constantly. As one hill dies, start another in its place. It will produce well until frost or freezing nights.

If space is at a premium, settle for two hills and keep replanting them. Even when the hills are still producing, punch seeds into the ground under the older plant and let the new growth move toward adulthood while the older plant is fading.

Pumpkins

One plant that thrives under nearly all growing conditions is the pumpkin. You can start a row or two of string beans and when the beans begin to climb the poles or cords you have set up for them, plant pumpkins between the rows and let the vines have their own way and cover the soil in the bean patch and beyond.

You may harvest two dozen pumpkins from the patch and, while the number is small, the size may be great. Pumpkins, like acorn squash, will keep indefinitely if you will leave them in the patch until they reach full maturity then take them indoors to a cool, dry place. We hauled some of our pumpkins in an old wheelbarrow into the storage area and simply left them in the wheelbarrow. They were

Cabbage is easy to grow and easy to preserve. It will keep for weeks as it is and it will last for a year or more in the form of kraut.

all sound and terrific when we were ready to use them.

Remember you can freeze, can, or dehydrate pumpkin and it will keep well if you don't have a good storage place for the whole crop. Pumpkin is nourishing and makes an appetizing pie. You can also bake the seeds for another treat.

Carrots

A crop that requires little space but produces well is the carrot. You can chop the soil finely around the perimeter of other plants, or under corn, and sprinkle carrot seeds into the soil. Carrots require very little attention and when you harvest them you can hang them in a cool, dry place and they will keep indefinitely. Or you can freeze or dehydrate them.

Lettuce

Make an all-weather lettuce bed (and sprinkle spinach seeds in along with the lettuce) and you can harvest greenery for salads and sandwiches all year. Best of all, you need not worry about canning or preserving in any way. Let the mature plants go to seed and they will reseed the patch. A recent issue of *Backwoods Home Magazine* (#54 Nov/Dec 1998) contains are article on the all-year lettuce patch.

Greens

Other inexpensive, easy, and long-lasting crops are greens. A pinch of seeds will plant a fairly large area and you will find that the crop will germinate within three or four days and within a few more days you can start picking and eating from the garden. We usually buy rape, kale, mustard, turnip, and radish seed (and whatever else looks good at the time) and sow them all together.

When the crop is far enough along, you can pick the greens and cook these, or you can add a turnip or two and maybe pick a few of the radishes for a special treat. Greens are filling and they are filled with vitamins.

You can use some of your corn to grind into meal and have your own supply of cornmeal for corn bread to enjoy with the dried beans and turnip greens.

Cabbage

Wherever there is a little space, set out a cabbage plant. You don't have to plant these in a patch the way it is traditionally done. You can grow one here and there, anywhere you can find the empty space. In a really efficient garden there should be very few places where the soil is visible during the height of the growing season. A cabbage plant will require about two square feet if the cabbage does well.

We have grown cabbages that are 36-inches across the huge outer leaves and weighed 12 to 15 pounds. You can keep cabbage indefinitely by putting the heads into a mesh bag or sack and hanging the sack in a cool, dry place. If you start to smell the cabbage as it becomes stronger and stronger, you can use it to make kraut, which will keep, essentially, forever.

Melons

If space permits, grow melons: watermelons, cantaloupes, honeydew melons, and others. You can eat the melons fresh or you can store them in a cool place, such as on the basement floor, for several weeks.

You can also dehydrate the melons, and they taste terrific with all the moisture removed. Check out a recent article in this magazine for details on how to dehydrate melons (#52 Jul/Aug 1998).

Wheat and rye

If you can, grow wheat or rye. Or both. You will need an area 100 feet long and 75 feet wide for a sufficient growth of wheat. You can start your wheat while it is too cold for other garden plants to grow and you will harvest the crop before you need the land for other crops.

When the wheat is mature, the plants will turn a golden brown and the seeds will be in a cluster at the top, like grass seeds. You can pull the grain by hand and later winnow it by rubbing a handful briskly to free the grain from the chaff. You can grind it in a small hand-operated grinder you can buy for

When you harvest your corn, prepare it immediately for storage. If it stands long, it will become tough. A small patch yields more than you would believe.

a fairly small amount of money. The grinders last forever under normal usage and, while you cannot grind the grain fast enough to produce enough flour to market, you can keep your own family supplied with flour for breads, gravies, pie crusts, and cakes.

Peanuts

Grow as many peanuts as you can. These tubers, which are not nuts but are in the legume or pea family, are very nutritious, and can be used in many recipes but are enjoyed most by eating them roasted, either in the shell or shelled.

It is rare to find anyone who does not like peanuts, whether in peanut brittle, as a substitute for pecans in pies, or on their own. You will need to grow a dozen rows 300 feet long if you have the space.

When you harvest the peanuts, you can pull the bush up and leave the tubers attached and haul the crop to the storage area. Later you can pick off the peanuts store these. Peanuts will keep for ages in the shell or outside it. Warning: mice, squirrels, moles, and other pests love peanuts, so you will need to keep them protected.

Soybeans

One crop that is absolutely priceless is the soybean, which grows easily and produces mightily. You can plant a modest patch (an area 100 feet long and 75 feet wide) and harvest all the beans the deer and mice leave for you.

Soybeans keep for years if they are protected in a closed container. Be sure they are well dried when you store them.

You can use soybeans to make flour, milk, and nearly anything else you want to eat. They are loaded with nourishment, taste terrific, and are versatile. One way we enjoy them is to put the beans in a pot, add plenty of water to cover them, then boil them for several minutes. After this, let the beans remain in the hot water for an hour or so then remove and bake them for one hour at 250 degrees. We salt them to taste and eat them like the roasted peanuts.

Herbs

Finally, grow your own herbs. You need only a tiny amount of space to grow basil, rosemary, mint, thyme, and the other popular members of the herb garden. These plants will dry readily and retain their vigor and pungency for months. That does it for the crops you can grow that are easy to cultivate and preserve, as well as those that will keep for long periods of time without any preparation whatsoever. This is not an exhaustive list: obviously many favorites were omitted. If you have your own favorites, add them to the list. Delete anything to which you are allergic or sensitive. Or if you simply don't like it.

And what if, after all this work, it turns out that the Millennium Bug does not happen at all? What if there simply are no major problems?

In that case, your only problem is how to eat all of that food you have stored. And that, folks, is one of the nicest problems you will ever have. Δ

By Alice Brantley Yeager
Photos by James O. Yeager

Connecting with the pioneers

through gardening and foraging

The term "living off the land" conjures up a vision of basic freedom. We try to put a rosy image on the days when small log cabins were the main dwellings for folks who were rebelling against what they considered government interference in their lives or who just wanted to be out on their own no matter what hardships they had to endure. Actually, the main requirements for living off the land involved more than a rosy image. It was imperative to own a few very necessary items: long-barreled flintlock rifle, gun powder, lead and bullet molds, hunting knife, axe, awls for stitching moccasins, iron cooking pots, etc. Life wasn't easy. Most of the essential items had to be obtained by barter with various animal hides such as deer, as the frontier folks had no way of manufacturing those things.

If we had to garden as the backwoodsmen and their families did, we'd quickly come to respect our modern tools and take care of them. Gardens were located in the clearings where the cabins were built and were mainly worked with crude tools fashioned from improvisation and stout tree limbs. Any metal parts of tools, such as hoe blades, had to be obtained by barter. People did not have much choice of seeds—corn, beans, and squash probably being some of the more widely cultivated plants. Seed saving was of prime necessity. Fortunately, many native food plants grew abundantly—various berries, greens of many sorts, Jerusalem artichokes, cat-tails, mushrooms, ferns, wild fruit, nuts, etc. Friendly Indians sometimes gave helpful information on the use of native plants. Otherwise, knowledge was gained on a trial and error basis.

We pass by many of our native plants today without giving them a second look. Not so with the frontier people. Wild food plants played a big part in their survival, as some of the plants were used to provide medicine, dyes, soap, and so on. For instance, from blackberry plants came berries for kitchen use and to make wine or brandy. In addition to culinary use, leaves were dried and roots were dug, cleaned, and dried for medicinal use and stored until needed as all parts of the plant are helpful in cases of diarrhea and dysentery. A teaspoonful of crushed dried root was mixed with a cup of boiling water, cooled, and drunk as a remedy. One or two cups per day were taken until the condition subsided. If fresh blackberries were in season, eating a large quantity of them also gave relief.

Nothing was so disheartening as to have a food garden wiped out by marauding Indians—and worse yet, the whole homestead. Today we gardeners fuss about slugs, cutworms, various plant diseases, and the neighbors' romping cats. Quite a contrast!

In yesterday's world, when the soil "played out" in a garden spot or game became scarce, the pioneering folk gathered up their possessions and

Left: Not only are tubers of the Jerusalem Artichoke delicious, but the plant has a fringe benefit. Its three-inch wide flowers are lovely to use in table bouquets.
Below: Tokyo Cross Turnips (hybrid) have become very popular with gardeners. Tops seldom attract aphids, and the roots are mild enough to use in salads.

Florida Broadleaf Mustard has a delightful tangy taste and is good raw or cooked. Easy to grow.

moved on to another area where survival was a little easier. Today we are more restricted in our desire to move and settle wherever a whim might take us. Also, we aren't in a fight for survival. (Of course, this depends on one's point of view.)

In our way we continue to live off the land, maybe not to the extent that our forefathers did, but the land is still here and how we use it is up to us. It's unusual now to procure one's meat supply by shooting a turkey or deer from the back door of a cabin. Instead we depend on our local markets, as there are plenty of suppliers making their living raising cattle, poultry, fish, and so on. As to the rest of the food entrepreneurs—well, they're called farmers if they have extensive acreage under cultivation. Those of us who like to have our own good quality food supply participate in a top rated recreation known as food gardening. We are not totally dependent on what we raise, but we do get a kind of deep satisfaction from living off our land, whether it is a small backyard garden or one that covers a half acre. Then there are those gardeners who like to eat, but don't give a hoot about vegetable gardening. They beautify the landscape with their flower pots and plots and enjoy their garden clubs. We tillers of the soil are a many faceted group and our roots reach far back into the annals of time.

Our gardens still contain many descendants of the plants that sustained the pioneers, but plants have been greatly improved through hybridization and selective breeding. Take greens, for instance. Those of us who love greens look forward to harvesting many types of greens—mustard, turnip, sorrel, etc. The plant breeders have given us superior tasting turnip greens such as Tokyo Cross and White Lady. Not only are the tops delicious, but the roots are of much better quality than the old types of turnips. The modern varieties can be used in salads as well as cooked.

Turnips

Fortunately, most vegetable seeds don't take up much room to transport and people immigrating from Europe to the New World often brought seeds with them. Turnips are thought to have originated in northeastern Europe, from which many immigrants came. Turnips are easy to raise during the cool part of spring and fall, and the plants produce an abundant crop of seed when they bolt with the coming of warm weather. Turnips will keep well when stored in a cool place. We have our refrigerators; some pioneers dug root cellars.

Mustard

Mustard is another plant of European origin which has become somewhat naturalized in places due to its huge crop of seeds. Not only is mustard desirable because of its tasty leaves, but the dried seeds may be used to make dry mustard. It is advisable to harvest the seed pods before they are completely dry, however, as the seeds scatter when the dry pods split. Clipping the stems and hanging them upside down in cloth or paper bags will contain the seeds that would otherwise fall. When thoroughly dry, the pods may be "threshed" inside the bags, and pods and trash winnowed leaving seeds ready for use. An electric blender comes in handy to reduce seeds to a powder which may be stored indefinitely in airtight jars.

One of our most popular mustard plants today is Florida Broadleaf. It is easy to grow and it will winter over where winters are mild, providing tangy leaves to use during the cold season. A tasty sandwich may be made from bread spread with butter or mayonnaise with a generous filling of fresh mustard leaves.

Peppergrass

Many wild members of the mustard family gave sustenance to the early settlers. One is peppergrass (pepperweed, poor man's pepper) which may be found growing in dry soils on roadsides, fields, clearings, etc., throughout the United States and southern Canada. The leaves have a peppery taste and may be used raw or cooked. They're best when gathered before the seed pods form in early summer. The seeds are useful, however, as they have a hot spicy taste and add zest to soups, stews, or salads. Seeds may be dried in the same way as regular mustard seeds. Rubbing the dry stems between your hands is probably the best way to separate seed pods from stems. There is no need to do anything further as seeds aren't easily separated from pods. Store in airtight containers and use when desired.

I remember peppergrass from childhood during the Great Depression when a quantity would be gathered to put with other greens. It takes quite a bit of peppergrass alone to make a pot of greens. Only the tender leaves should be cooked, as the stalks are usually tough.

Sheep Sorrel (Rumex acetosella - Common Sorrel, Red Sorrel) has tiny clusters of reddish flowers along a tall stem. Tiny seeds are relished by ground feeding songbirds and foraging animals may devour the whole plant. 3/4-2 inch leaves are lance shaped with two lobes pointing outward near the leaf stem. Height is 6-18 inches.

Sheep sorrel

Those of us who have been fortunate enough to spend some of our early years in the country remember walking along paths where sheep sorrel grew in abundance. I have often picked a sorrel stem and savored the sour taste of both stem and arrow-shaped leaves. This is another plant that gives a good account of itself when leaves are mixed and cooked with other greens, or used in salads. In our garden we have French sorrel, the improved version of sheep sorrel. French sorrel has large leaves and is not so tedious to gather and rinse. Both native and improved varieties are perennials. The natives are found almost all over the United States.

There are so many useful native greens that it is impossible to mention them all—lambs quarters, purslane, poke salad, plantain, dandelion, dock, and so on. Many are perennials and will come up year after year if left undisturbed. Most can be found throughout the United States and southern Canada and some into Mexico. If you cannot go foraging for the natives, most can be grown in gardens, taking care not to let them become invasive.

Jerusalem artichoke

Some plants yield nutritious tubers and these are usually dug after the plants have gone dormant. One of the best known is the Jerusalem artichoke, long cultivated by Indians and now found almost all over the United States. Jerusalem artichokes yield small potato-like, knobby tubers with a delicious nutty flavor. When digging the tubers it is best to dig only what is needed, leaving the rest in the ground or dug and covered with earth in a convenient place close to the kitchen. Tubers keep better covered with soil than when cleaned and refrigerated. Jerusalem artichokes may be eaten raw as a snack or in salads, and they are great fried, boiled, or scalloped. Simply wash the tubers, scrub them with a vegetable brush, and cook them as you would potatoes. (No need to peel.) The “chokes” have an advantage over potatoes as they contain no starch, but rather the carbohydrate inulin, making them safe for diabetics.

We have found through experience that Jerusalem artichokes are best grown alongside a fence as the plants can reach six to eight feet in height and tend to fall over on other plants if beset by strong winds. They can be loosely tied to the fence preventing a lot of frustration and bad words. Plants will grow in multiple soils, but seem to do best in poor soil.

Wild garlic & onion

The frontiersmen were not without plants to enhance the flavor of their meat and vegetable foods. Nothing is so widespread as members of the Allium genus and this includes wild onions, wild garlic, leeks, and chives.

Peppergrass (Lepidium virginicum, one of many peppergrasses) has tiny white flowers in cross form at tips of stems. Seeds are small, round and encased in flattened papery covers with a slight notch at the top. Leaves are lance shaped and may have several small side lobes. Overall height ranges from six to thirty inches.

If in doubt of identification, use your nose, as these plants have a distinctive onion or garlic smell. All of these are easy to grow, but, like some other plants, they may try to take over a garden. As plants tend to go dormant when hot weather advances, it may be well to snip and freeze the tops when young and tender. The bulbs may be dug when dormant and spread out to dry in a shady spot. When dry, brush off dirt and store in cheesecloth bags hung in a cool room. Use when needed.

Fruits and nuts

Native fruits and nuts composed a goodly part of the pioneers’ menu. Wild plum thickets produced tart fruits for jams and jellies. Other desirable wild foods were blueberries, elderberries, blackberries, dewberries, pawpaws, muscadines, wild grapes, crab apples, persimmons, hickory nuts, native pecans, butternuts, American chestnuts (now virtually

Wild garlic is easily recognized by its growth habit of sending up a stem topped by star-shaped, pinkish-white flowers surrounding a cluster of small bulblets. The plant's grass-like leaves come up in January in the South and is easily identified by its strong onion-like odor.

wiped out by chestnut blight), black walnuts, chinquapins—the list goes on and on. Many of these natives are available today, but not in the quantities found in frontier days. Due to careless loggers, city and highway expansion, clearing of land for agriculture, etc., it is not easy to find sons of the wild plants on which the pioneers depended unless one has access to large wooded or wilderness areas.

It is still possible to forage some good things from the land, but much of it is fenced or owned by people who take a dim view of others roaming around on their property. Before climbing over any fences or trespassing on open fields or woodlands, it is well to get permission from the owner.

Poke salad

Assuming all is well with the landowner, foraging for food plants is fun. In our area (southwestern Arkansas) one of the dependable native plants is poke salad. Poke is a perennial and comes up early in the spring. Some folks cut the young shoots at ground level, but this is not a good practice as cutting the main stem can destroy a plant. It's best to clip leaves from the plant and leave the stem unharmed.

Poke leaves are easy to clean, as insects such as aphids leave poke salad alone. Just swish the leaves in some clean water to get rid of any dust particles, and parboil, that is, bring the leaves to a boil for about three minutes in a small amount of water and drain. (Use plenty of leaves as they cook down considerably.) Put in fresh water, season as you would any greens, boil until tender and that's all there is to having a delectable pot of poke salad. Pour off water and serve. You may like to top your dish of poke with some sliced hard boiled eggs.

As a plant matures, it will produce small greenish-white flowers and then berries which will turn purple-black when mature. It is well to stop harvesting leaves when the small flower heads begin to appear, as poke is also a poisonous plant when it passes a certain stage in its growth. Leaves and stems begin to turn red. Maybe this is Nature's warning sign as the plant's phytolaccic acid content increases. If you're into making ink or dyeing, the plant is still useful as the mature berries produce a nice deep royal purple color. Birds are fond of the berries and love to eat a quantity and then bomb the nearest clothesline.

Poke salad is an easy plant to raise in a garden, but it is tall growing and should be planted along a fence out of the way of shorter plants. It is a stout plant and is seldom blown over by strong winds. Just watch for poke berries in the fall on a mature plant and save some of the seed. Plant them in the spring and thin seedlings to stand about 18 inches apart. It's best to wait until the second spring before harvesting some leaves. Poke is a perennial and will serve you well once it is established. Poke does not seem to be particular as to soil, although it is found growing at its best in rich barnyard soil.

If you are interested in foraging or raising your own native plants you should either purchase a book on native food plants or find someone who actually goes out and forages. Hands-on experience is always the best teacher. The most expensive books covering the whole United States are not necessarily the best, so browse around for a book that contains considerable information about plants in your area and gives recipes for using the good things you want to harvest.

Foraging for useful native food plants is guaranteed to open up a whole new world for you just as it did for the early settlers. It's still possible to enjoy many of the plants that served them well. Δ

SEED SOURCES

Tokyo Cross Turnip

J.W. Jung Seed Co.
335 S. High Street
Randolph, WI 53957-0001

Vermont Bean Seed Co.
Garden Lane
Fair Haven, VT 05743-0250

White Lady Turnip

Geo. W. Park Seed Co.
1 Parkton Ave.
Greenwood, SC 29647-0001

Florida Broadleaf Mustard

Vermont Bean Seed Co.

French Sorrel

Geo. W. Park Seed Co.

Jerusalem Artichoke

Vermont Bean Seed Co.
J. W. Jung Seed Co.

Gurney's Seed & Nursery Co.
110 Capital St.
Yankton, SD 57079

Ayoob on Firearms:

What if they break down my door?

Massad Ayoob

The computer boffins are taking Y2K seriously. They are streaming into gun stores with open checkbooks and ordering multiple guns and large quantities of ammunition right out of Mel Tappan's classic survivalist book, Survival Weapons. Their fears are that too many computers are unprepared for the turn into the 20th century.

As of fourth quarter 1998, U.S. Government officials held out little hope of their own computers being fixed in time and there are fears of things going awry as the Millennium dawns. Best case predictions are that government agencies not only will have trouble issuing income tax demands, but may grind to a halt and stop issuing checks for welfare, social security, government pensions, and other monies that countless thousands of Americans depend on as their lifelines to survival. In a best case scenario, the relevant governmental agencies will have stockpiled and be ready to issue redeemable chits that can be accounted for the old fashioned way, in ledger books. They will have made it clear to the public that they'll make good on them so the paper will seem as "good as gold."

A worse case prediction is that deliveries of critical freight—not only foodstuffs, but fuel, since winter will be approaching its vicious peak in many parts of the country at the moment the Y2K bug is expected to attack—will be disrupted. This will cause some people to die of starvation or exposure, and cause others to become ready to kill their neighbors for food and fuel to keep that from happening.

The very worst case scenario has computer-controlled nukes going into launch mode by themselves, creating the equivalent of World War III and the kind of thermonuclear devastation that had some of our parents and grandparents building fallout shelters in the 50s and early 60s.

The doom-sayers see anarchy resulting, with ravening, homicidal mobs not only in the streets but foraying into the hinterlands to kill rural people for their food and firewood.

I don't personally expect anything as drastic as these scenarios. On the other hand, I was nine years old and in fourth grade when I figured out that if you were an optimist, the best you could ever hope for was that things would go exactly as planned, and the rest of the time you would be bitterly disappointed. However, if you were a pessimist, the worst that would ever happen would be that things would go exactly as planned, and the rest of the time, you would be pleasantly surprised.

Official preparations

It has been said that the Royal Canadian Mounted Police have already had all their leaves cancelled for the period around New Years 2000. In the United States major police departments have already cancelled all leave not only for the period around New Year's Day 2000 AD, but for the end of the following February, when many experts expect a second "aftershock" to strike the computer world.

I am a captain with a municipal police department. I got married on December 31, 1971. My lovely bride chose that date, she told me, for tax reasons. No matter: New Year's Eve is my wedding anniversary. I have always been able to manipulate the schedule so I didn't have to work for my police department on New Year's Eve. Not this time. My Chief of Police has already told me that I'm to be on duty on that particular night as Y2K makes its entry. No problem. I understand why that's needed.

Nicole Veash of the London Observer blew the whistle in December of 1998 on the fact that Action 2000, the British "government's millennium bug task force," strongly suggested that all British citizens store up a two-week supply of food and other essentials well in advance of fourth-quarter 1999. Said Veash, "In an unprecedented statement indicating the level of panic in official circles, the Department of Trade and Industry-funded task force, charged with minimizing the potential damage caused by the bug, has said that contingency planning for a worst-case scenario should start as soon as possible."

Veash quoted Gwynneth Fowler, head of Action 2000, as saying: "We are talking about people having a judicious amount of surplus food in their kitchen cupboards. Anyone sensible

would plan for this. Because we don't want to see panic buying in the weeks leading up to next (1999) Christmas, consumers should think about this in advance."

I think this is prudent advice. For a long time now, I have kept cases of canned food in my basement. "Just in case." Because my family didn't especially like canned food, some of it got eaten at home but most of it wound up being donated to the homeless.

As Year Two Thousand approaches, I can tell you right now that this supply of canned food is going to stay in my basement until the threat of the Y2K bug has passed. It will stay until well past the end of February 2000 when the computer experts say the aftershock may come.

Personal preparation

Backwoods Home Magazine editor Dave Duffy is taking Y2K seriously. You'll be seeing more about it in forthcoming issues. He has asked me to set aside less urgent topics and write more on this one. "What gun does my reader want to have in his or her hand," he asked me, "when a gang of hungry marauders starts kicking down their front door?"

The answer is, one that shoots lots of powerful bullets fast and straight. Shotguns are slow to reload. I never bought into the term "assault rifle" for the semiautomatic rifles that Sarah Brady, Diane Feinstein, et al want to ban. This situation, however, could change my mind semantically. If I was faced with a charging elephant, I'd want an elephant rifle. If faced by an overwhelming assault, I'd want an "assault rifle."

The terms are academic and will become much more so if some of the predicted scenarios come to pass. A high powered semiautomatic rifle that fires lots of bullets makes enormous sense in the kind of situation that has been predicted.

The .223 (5.56mm NATO) caliber is a proven manstopper. Its recoil is light, even though its blast is loud. If cost is no object, the AR-15 has the best human engineering. The original Colt, and the current productions of Bushmaster, DPMS, and Olympic Arms, are the best made and most reliable. They are easy to shoot from all manner of awkward positions while behind cover, and no such rifle is faster to reload in an intense firefight.

If cost *is* something of an object, you can't beat the Ruger Mini-14 for value in a semiautomatic .223 rifle. My police department issues them for road patrol, and I've learned to appreciate the Mini as a splendidly reliable tool. One of the firearms instructors on my department recently attended Clint Smith's famous Urban Rifle School. He told me afterward that he was struck by how well the superbly-reliable Mini-14 had performed in that demanding environment compared to many tricked-out custom guns that had cost several times more.

If cost is a big object, consider the SKS rifle. A 10-shot weapon in caliber 7.62X39, it won't blow as wide a hole as the extremely high velocity .223, but it can be had cheap in gun shops and at gun shows. It is as reliable as the AK-47 that replaced it as a standard military weapon in the Communist Bloc, and it is generally more accurate. However, for a number of reasons, I'd much rather have an American made .223.

Handguns

Don't, however, neglect the handgun. In times of panic, people walking around in public with rifles provoke fear. Frightened people with guns of their own tend to shoot at the source of their fear. In short, walking around with a rifle or shotgun could draw fire from panicky citizens.

Folks will still be coming to your door. Are they home invaders? Starving brigands ready to kill for food? You'll want something at hand more potent than a door key. Do you want to answer the door with a 12-gauge or mini-14? If it's someone in trouble you'll scare them to death. If it's the cops, come to tell you they've recovered your car that you didn't realize was stolen yet, I can guarantee that as soon as they see the shotgun, things will go downhill fast.

A handgun is the ticket. Tucked into the waistband or pocket, it's out of sight and "doesn't frighten the horses." With the pistol concealed, you don't feel like Rambo going to the door. And something is always where you can reach it.

A friend of mine is a veteran cop and gunfight survivor on a West Coast police department. His Glock pistol is on his hip from when he gets dressed in the morning to when he undresses at night, on or off duty, in uniform or not. "I've responded to a lot of home invasions," he explains. "They happen quickly. You're not going to have time to run from the living room to the bedroom closet to get your shotgun."

My friend finds the eighteen 9mm rounds in his Glock 17 to be reassuring. His family and circle of friends have gotten used to him always having an exposed pistol on his hip. If that doesn't fit your lifestyle, something smaller, worn concealed, will do the job. An ankle holster is one approach. Small revolvers work best for this—Smith & Wesson, Colt, Ruger—but a few of the smaller service-grade auto pistols will survive the grit that accumulates on a gun that is carried in an ankle holster just inches above the ground. If you prefer semiautomatics, the subcompact Glock 26 and the Kel-Tec P-11 will both hide in an ankle holster with loose pants, and each is an 11-shot 9mm.

Another low-profile option is a pocket holster like the one made by Greg Kramer. It works particularly well with a light, snag-free revolver like the S&W Centennial "hammerless" series. The Airweight Model 442 weighs under a pound, and the new AirLite with titanium cylinder weighs only eleven ounces unloaded. Both are five-shot .38 Specials. You can order

a pocket holster by phone from Kramer at (800) 510-2666.

Home invasion

Why all this talk of home invasion? One concern in the police community is that home invasions are predicted to skyrocket as the Millennium gets closer. The theory is that heavy media attention to the problem will mention that runs on banks have been predicted (remember the Great Depression?). Fairly early in 1999, people will start cashing out their savings accounts and bringing the money home for fear of losing it in cyberspace when the bank's computers crash on the morning of New Year's Day 2000.

This trend will get lots of publicity. Criminals read the newspapers too, and even the illiterate ones watch TV. They will realize that a whole lot more ordinary homes are now likely to contain large, "life savings size" piles of cash.

It is for this reason that a handgun concealed on your person at home will start to make more sense than ever as these corollary downsides to the Millennium Bug continue to develop.

If you're going to carry a handgun in public, make sure you're in conformity with local law. You generally require a carry permit unless you're on your own property. There are few exceptions. The state of Vermont does not require a permit to carry a concealed handgun in public. The state of Ohio has no provision for concealed carry, but does have an affirmative defense written into the law. This means that the defendant charged with concealed carry will be acquitted if he shows that any reasonable person would have armed himself under the same circumstances. Finally, the state of California has an obscure law that authorizes citizens in times of emergency to carry a concealed handgun for protection while awaiting the arrival of police who have been been summoned.

This subcompact Glock 26 holds eleven rounds of 9mm, in this case Pro-Load Tactical hollowpoint.

At least one handgun per household member who is competent and responsible to use it makes sense. Keep ample ammunition on hand. If you (and other family members) haven't been trained, this is the time to schedule the instruction. Make sure the guns are clean and in good repair. Do the same maintenance on things like generators and all the rest of your emergency "just in case" equipment.

One thing must be remembered, though: as with Hurricane Andrew, the Rodney King riots, and other things that in recent years brought decent citizens out in force with their semiautomatic weapons, the temporary absence of law enforcement won't mean an amnesty on murder. You'll still be held to account in the future for any act you commit with the gun even in an emergency. Be certain that you're justified, even then, in levelling a gun at another human being, let alone pulling the trigger.

One way or another, society will return after even the worst case scenarios that have been predicted for Y2K. The Law, with no statute of limitation on the crime of murder, will return with it.

AirLite titanium, left, and Airweight S&W five-shot .38s work for discreet, all day pocket carry.

My own plans

It has already been determined that I'll be away from my home on the night when this happens or doesn't happen. I'll be in a police patrol car waiting, like the rest of you, to see "what happens."

In that patrol car will be my department's standard issue weapons—a 12-gauge semiautomatic shotgun and a .223 caliber semiautomatic rifle. Don't be surprised if on that particular night I also have within reach a .308 telescopic-sighted "long rifle" that will hit within less than an inch of its point of aim at 100 yards. None of these would be bad things to have at home on that particular night, either.

On that same night, each officer in our department will be a quick reach away from a .45 caliber semiautomatic department issue service pistol, with the department-mandated two (minimum) to four (maximum) spare magazines carried on the duty belt. On that night, I expect to see more "four" than "two." In any case, we have spare ammo readily available in the patrol cars: 12 gauge, .223, and .45 ACP.

While I'm away at the police department, I have no doubt that my wife and kids can handle things. The necessary supply of food, toilet paper, and everything else will already be in place. So will the guns. Anyone feloniously trying to invade the space of my wife and daughters will end up like the unfortunate invaders in the classic "Roach Motel" advertisement. You remember the slogan: "They check in, but they don't check out."

But with a little bit of luck this won't be nearly as bad as predicted. Some time in March of 2000 we'll all look a little sheepishly at each other. There will be mass donations of stockpiled food to food banks. I hope.

I love happy endings. But the history of the world is that bad things are most likely to happen to people who don't prepare for them. It's a history we all want to keep in mind as Y2K's moment of truth draws nearer. Δ

CHOCOLATE

Food for the Gods

My mother loved chocolate. She knew and understood it just as a wine master knows and understands wine. When she made some of her old world style bittersweet hot chocolate, the aroma filled every corner of our small apartment. Other days she might make one of her many chocolate fudge recipes, cakes, pies, puddings, brownies, or some other chocolate goodies. Consistent with her nature, she shared all of these treats with neighbors, friends, family, and anyone who was lucky enough to pay us a visit.

A few weeks ago I was struck with a hard to resist urge for a cup of Nanna V's old world style hot chocolate. I started to rummage through her old suitcase full of recipes trying to find, as she used to say, "a hot chocolate formula." I found several hot chocolate recipes stuffed in a large manila envelope along with two tattered notebooks. In one notebook my mom had scrawled a bunch of her chocolate recipes, along with some interesting facts about how chocolate is made. The other notebook was full of detailed notes on candy making. There I found the secret to the dozens of elegant candies and other treats that she gave as gifts to everyone during the holidays. After a few minutes of browsing through this newfound treasure it occurred to me that there was fun to be had with this stuff. I selected a bunch of the chocolate recipes and headed for the supermarket with my three kids—Sarah, Jason, and Michael. They're a nosy bunch that never lets me go on shopping expeditions alone, especially if they suspect I'm working on some new recipes. We returned home with enough chocolate, sugar, and other related ingredients to start our own dessert shop. I didn't waste time. I whipped up a batch of hot chocolate right away.

During the following three weeks the kids and I used my mom's recipes to prepare a variety of chocolate desserts and beverages. We made cakes, brownies, pies, puddings, six chocolate drink formulas, and more fudge than I can remember.

My children are hard-nosed food critics. They even formed a food review panel to critique my recipes. Any recipe included in these columns must first get a unanimous

Richard Blunt

thumbs up from the panel. It took many serious tasting sessions, followed by a lot of lively conversation, before the panel finally gave me an accordant vote on the following three recipes.

Also, Sarah made a special request. "Hey, Dad, when you do the recipe article, tell the folks some of that cool stuff about cacao trees and how chocolate is made. Nanna V would like that." What is it about 13-year-old girls that turns fathers to mush?

The word cocoa is a modification of the Spanish word cacao. The two words are often used interchangeably, but for the trees and beans, from which we get all things chocolate, we usually use the word cacao. The cacao tree is a tropical evergreen belonging to the theobroma genus. Literally translated from Greek roots, theobroma means "drink of the gods." These delicate trees originated and continue to thrive in the hot, damp rain forest climate of the South American river valleys. Being very sensitive to light, cacao trees grow in semidarkness under the protective mantle of taller trees. These unique growing conditions exist exclusively in a band around the earth that extends 20 degrees above and below the equator.

Cacao trees were first cultivated by the Mayas around the 7th century A.D. They carried the seed north from the tropi-

NUTRITIVE AND STORAGE VALUE OF CHOCOLATE

Chocolate is a high caloric food due to its cocoa butter (a vegetable fat) content. Combine this with the sugar found in chocolate candy and you have concentrated energy in a very small package. Chocolate also contains caffeine, the same stimulant found in coffee. So, as you are assembling your disaster food supply, don't forget candy, especially chocolate.

Chocolate has long been considered a lightweight and nutritious survival food by the United States Army. Three 4-ounce chocolate bars have been a standard part of the Army's D-rations since World War II. Researchers have even found a natural way to raise the low melting point of chocolate above 105 degrees F. Minute quantities of water are added to the chocolate formula to prevent the fats from blending together. This made it possible for soldiers to carry their D-ration chocolate bars during the Gulf War.

Chocolate, when stored as cocoa powder, has a reasonably long shelf life because of its low fat content. Higher fat-containing chocolate stores very well at root cellar temperatures (48° to 55° F) or refrigerator temperatures. But hard chocolate (milk or bittersweet chocolate) can undergo "fat bloom" or "sugar bloom" in which the fat or sugar crystallizes while in storage, and develop those unappetizing light spots. Despite these spots it is still edible and retains its food value. It is also interesting that the chocolate content in milk chocolate helps to keep the milk in the chocolate from going rancid, and thereby adds to its shelf life.

Few of us would consider candy a health food but all of us have had moments when some form of candy has been beneficial to the soul. Children, especially, will benefit from a mouth watering piece of candy during stress-filled times.

cal Amazon forests to what is now Mexico. In the 16th century the Spanish planted cacao trees across South America, into Central America, and onto the Caribbean Islands. In the 17th century the Dutch transported the cacao tree to other places around the globe like Java, Sumatra, Sri Lanka, New Guinea, and the Philippines. Early in the 19th century the Portuguese planted cacao trees on an island off the west African coast. By the end of the century they were being cultivated on the African mainland along the Ivory Coast. Today these combined tropical regions produce over two million tons of cacao beans. The finest and most sought after beans, however, are still grown in the New World.

The Maya, Toltec, and Aztec people of early Mexico prepared a hot chocolate drink of ground roasted cacao beans mixed with chili peppers and water. This popular combination of ingredients produced a very bitter, sharp tasting drink.

The first Europeans to discover the cacao bean were crew members sailing with Christopher Columbus on his fourth, and last, voyage to the New World in 1502. Columbus returned to Spain with a sack of cacao beans. Little interest, however, was shown in the bitter, sharp tasting drink that the beans produced.

Cortez and Montezuma

Seventeen years later the Spanish navigator, Hernan Cortez, sailed to the New World to plunder the West Indies. When he reached the mainland, the Aztec king, Montezuma, thinking Cortez to be a god returning to claim his lost kingdom, presented him with an abundance of treasures from the Aztec empire. This included a large amount of cacao beans. Unlike Columbus, Cortez immediately saw potential economic value in cacao. When he asked Montezuma where the treasures were, he was taken to a large stand of cacao trees. Cacao beans were the valued currency of the Aztecs. With a wealth of cacao beans in his possession, Cortez was able to trade for a fortune in gold. When Cortez returned to Spain in 1527 he brought with him a large cargo of cacao beans and a passion of his own for chocolate.

As Europeans began to colonize the New World they began planting sugar cane in Haiti and the Dominican Republic. One day someone came up with the idea of adding sugar to their chocolate drink hoping to make it more palatable. Well, the addition of sugar created an instant passion among the colonists. The infatuation with this new sweetened chocolate spread rapidly to other conquered territories and finally back to Europe. It is believed that chocolate was one of the factors that sparked the development of sugar plantations in the New World.

By the beginning of 17th century, hot chocolate gained a great deal of popularity among the wealthy Europeans. Europeans also valued chocolate for its nutritional and stimulating qualities (see sidebar). Many also believed chocolate to be an aphrodisiac and a cure for a variety of physical and mental disorders. Late in the 17th century the first ready-to-eat chocolate in solid form made its appearance in London. This new innovation became an immediate curiosity to chocolate lovers. But because of its dry crumbly texture, chocolate in this early solid form received a cool reception in Europe. However, changes for the better were on the way.

The American and French Revolutions, along with the Napoleonic Wars, brought the production and development of chocolate to a temporary halt. The return of peace in the early 1800s, followed by the Industrial Revolution, sparked important changes in the chocolate industry. Innovations by French and Dutch manufacturers improved both the taste and texture of chocolate in all forms. The improved chocolate products were supported by flourishing cacao bean production around the world. These advances paved the way to making chocolate—once a delicacy reserved only for the wealthy—an everyday treat available to all.

The cacao tree

Cacao trees bear their fruit in the form of gourd-like pods that grow directly from the tree's trunk and the base of its larger branches. Each pod contains as many as 40 almond-shaped seeds embedded in a white bittersweet pulp. There are three main varieties of cacao beans grown around the world.

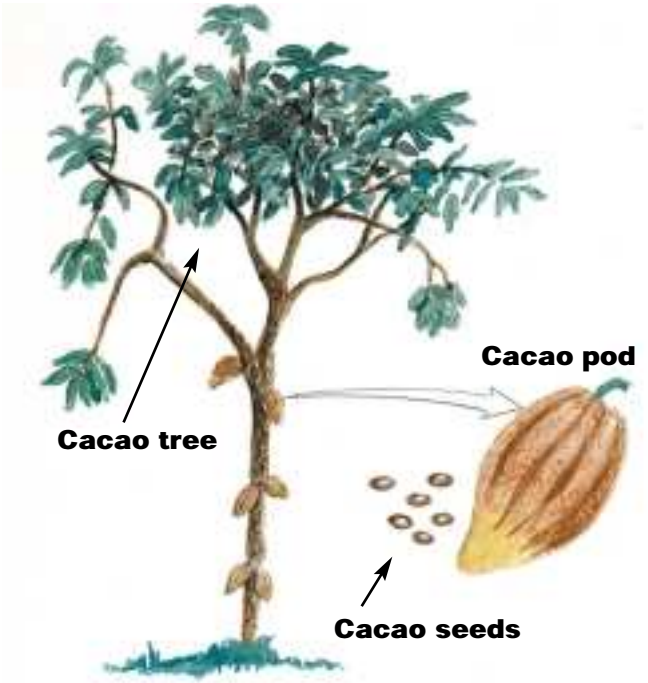
The original bean, cultivated by the Aztecs, carries the Spanish name, **criollo**, which means indigenous. This is the finest and most sought after cacao bean. It is very aromatic, with a slightly bitter flavor.

Next is the hardy, fast growing **forestero**, which means foreign in Spanish. The forestero has a very acidic aroma and a strong bitter flavor and represents over 80 percent of the world's cacao bean production. Africa is the largest producer of forestero cacao beans.

The third variety is a crossbreed between the criollo and the forestero. This variety is grown in several parts of the world and its quality depends on where it is grown. The finest of these beans are grown in Central and South America. These three main varieties have several sub varieties, each having their own characteristic flavor and aroma. Makers of the Grand Crus quality chocolates will use the finest single variety cacao bean they can find. However, the vast majority of chocolate products are made from the subtle blending of a variety of carefully chosen cacao beans.

Picking and fermentation

When cacao pods ripen they are cut from the tree by experienced pickers using razor sharp machetes. The pods are split open almost immediately and the seeds, covered by a sticky white pulp, are removed and piled into baskets. Anyone curious enough to taste one of the seeds at this point will experience a bitter, acrid taste not at all like chocolate. After being removed from the pod, the beans are allowed to ferment in the pulp. During this magical process the embryo is destroyed, preventing germination, and nearly 500 substances inside of each bean become active. The final flavor of the bean is determined during this critical process.



Depending on the variety of bean, fermentation will be allowed to continue from three days to a week. The length of the fermentation will determine the strength the bean's final flavor. The longer the fermentation, the stronger the flavor. Each variety of bean, depending on where and how it is grown, requires a carefully calculated fermentation process. For some varieties, if the fermentation is too long the seeds can develop an overly strong, acrid flavor. For other varieties, too short a fermentation will leave the bean almost flavorless.

The final destination of the beans will most often determine the fermentation process. Beans shipped to most English speaking countries will be fermented for a short period, producing a fairly mild, almost bland flavor. Cacao beans intended for French markets will undergo a longer and slower fermentation which produces a strong, full-flavored bean.

After fermentation is complete, the beans are usually sun dried for one to two weeks. They are then cleaned, sorted by size and color, packed into jute sacks, hermetically sealed, and stored in cool warehouses to await shipment. With shipping, the grower's job is usually done. Processing of the bean into chocolate is then preformed by manufacturers all over the world.

Art, science, or magic?

Preparing the dried beans for the production of chocolate and cocoa is a very sophisticated and precise process. As soon as the beans arrive at the manufacturer's factory they are fumigated and cleaned to remove any dried pulp or other matter. The beans are then roasted at a temperature ranging from 250 to 350 degrees F for thirty minutes to two hours. The roasting process sparks the many substances activated in the bean during fermentation into performing their alchemy. The slow roasting process creates subtle

browning flavors which combine with these substances to develop the familiar aroma and flavor of chocolate in each bean. The exact time and temperature of roasting is dictated by the quality and variety of the bean. Each variety of bean is usually roasted separately to insure quality results. The beans are then blended according to the manufacturer's closely guarded formula.

After roasting, the beans are broken open and the shell is separated by controlled currents of air. The inner portion of the bean is now referred to as a nib. The nibs are ground into a thick paste, called chocolate liquor, which consists of small particles of nib suspended in an indigenous fat called cocoa butter. A second grinding is often performed to reduce the particle size of the nib to a desired range. Further processing of the nib depends on the intended product.

If cocoa powder is to be the end product, most of the cocoa butter is removed using a special press. The resulting paste is then formed into cakes and ground one more time.

Nanna V's never-fail fudge

butter, margarine, or shortening for greasing a pan
1½ cups granulated sugar
½ cup brown sugar, packed
2 oz. unsweetened baking chocolate, chopped into pieces
¼ cup unsweetened cocoa powder
2/3 cup evaporated milk
2 Tbsp. light corn syrup
2 Tbsp. unsalted butter
1 tsp. vanilla extract
½ cup pecans, broken into medium-size pieces

Method:

1. Carefully line a 9x5x3 loaf pan with a piece of aluminum foil large enough to extend over the edges of the pan. Coat the foil with butter, margarine, or vegetable shortening and set the pan aside.

2. Coat the sides of a heavy-bottom two-quart sauce pan and set the pan aside. This simple step will prevent any sugar from sticking to the sides of the pan and causing trouble later on.

3. In a suitably sized bowl combine the sugars, chopped baking chocolate, cocoa powder, evaporated milk, and corn syrup. Carefully stir the mixture with a wire whisk until all of the sugar is dissolved. Transfer the mixture to the heavy-bottom saucepan. Take great care not to splash any of the mixture on the sides of the pan.

4. Over medium heat bring the mixture to a slow boil while stirring constantly. Remember, it is important to avoid splashing any of the syrup onto the sides of the pan. Now clip the candy thermometer to the side of the pan. To get an accurate reading the fudge mixture must cover the bulb of the candy thermometer while the fudge is cooking and cooling. Continue to cook and stir the fudge until the thermometer reads the desired temperature. Without removing the thermometer, take the pan from the heat, and add the butter without stirring. Let the mixture cool until the thermometer reads 110 degrees F. Depending on the ambient temperature of your kitchen the cooling will take from 45 minutes to an hour. Note: If your candy thermometer is not designed so that it will clip to the pan, throw it away and buy one that does.

5. When the fudge has cooled to 110 degrees, add the vanilla. Now comes the tough part. Find a comfortable kitchen chair and sit down gripping the pan between your knees. Start stirring the fudge slowly with a wooden spoon to incorporate the butter. Continue stirring, as vigorously as possible until the fudge begins to lose its shine and starts to thicken. Now, quickly stir in the broken pecans. The fudge should be too thick to pour, so push the fudge into a smooth layer in the foil lined pan using your fingers. Avoid scraping the pan. Pan scrapings are usually too dry. I call Sarah, Jason, and Michael, give them each a spoon, and set the bowl on the table. The bowl is back on the counter, shiny clean, in about a minute.

6. When the fudge is firm, in about 15 minutes or sooner, use the foil to lift it from the pan and cut it into squares. When in a hurry, I skip molding the fudge into the pan. Instead, I turn the fudge onto my marble bread board, knead it until it becomes stiff and roll it into half ounce balls.

If you are new to candy making don't let all of the sugar syrup science stuff intimidate you. People have been making fudge for generations without knowing anything about the science behind saturated solutions. I include it because those of us who are serious about cooking want to know what is happening with our food at all times.

The resulting powder is sometimes treated with an alkaline solution to raise the pH of the powder from slightly acid to neutral. This simple process, called Dutching, darkens the cocoa, mellows its flavor, and makes it easier to mix the powder with a liquid. Of all chocolate products, cocoa powder contains the least amount of cocoa butter—from 10 to 20 percent.

Chocolate liquor destined for production into baking chocolate or one of the many types of ready-to-eat chocolate is treated very differently from cocoa powder. Bitter

Glazed spiced mocha brownies

This brownie recipe was one of the more recent additions to my mom's list of chocolate goodies. Along with the chocolate it contains many of her lifelong favorite flavor enhances: coffee, fresh nutmeg, almonds, and black pepper. That's right, black pepper. Even I was uncertain of how the pungent fungus-produced flavor of black pepper would blend with chocolate. Especially chocolate that is mellowed by sugar and a variety of aromatic ingredients. The uncertainty was quickly dispelled after taking my first bite from one these marvelous brownies. Since then I have made black pepper a standard flavor enhancer in many of my chocolate favorites, especially hot chocolate. This recipe really demonstrates my mother's passion for and knowledge of chocolate. There is enough chocolate in these brownies to satisfy the most diehard chocolate fans. The chocolate is enhanced with the subtle amounts of rich flavor enhancers like coffee, fresh nutmeg, and vanilla extract. Then a little black pepper and molasses is thrown in to add zip. The molasses, of course, is hiding in the brown sugar. Give these brownies a try and let me know what you think.

Ingredients:
soft shortening
5 oz. bittersweet chocolate
6½ oz. unsalted butter
1/8 tsp. Kosher salt
½ tsp. powdered, instant espresso coffee
½ tsp. fresh ground black pepper
¼ tsp. fresh grated nutmeg
½ tsp. pure vanilla extract
1 cup dark brown sugar, firmly packed
3 large eggs
¾ cup sifted all purpose flour
1 cup pecans, broken into large pieces

Method:

1. Prepare a 12-inch square baking pan by coating the sides and bottom with soft shortening. Place a piece of waxpaper, cut to fit, on the bottom of the pan. Coat the wax paper with soft shortening, dust it with flour, and shake off the excess. Set the prepared pan aside.

2. Place the bittersweet chocolate in a double boiler over medium heat. When the chocolate is melted, stir it with a wire whisk until it is smooth and set it aside to cool slightly.

3. Cream the butter in the large bowl of an electric mixer. Add the salt, instant coffee, black pepper, nutmeg, vanilla extract, and brown sugar. Beat the mixture until all of the ingredients are blended. Now add the eggs, one at a time, beating the mixture just enough to incorporate each egg. Scrape the bowl with a rubber spatular after incorporating each egg.

4. With the mixer on low speed, add the melted chocolate, then the flour to this mixture. Stir the bowl using a rubber spatula to get the mixture away from the sides, then continue mixing, at low speed with the electric mixer, until all ingredients are incorporated.

5. Remove the bowl from the mixer and stir in the nuts using a wooden spoon.

6. Turn the mixture into the pan, smooth the top, and bake for about 30 minutes or until a toothpick inserted into the middle of the brownie comes out slightly moist. It is critical not to overbake this brownie. Doing so will give it a dry crumbly texture.

7. Remove the brownie from the oven and let cool in the pan for 30 minutes. Then place a cake rack over the pan and invert the pan and the rack together. Remove the pan and peel off the wax paper. Turn the brownie right side up by placing another cake rack over it and inverting the whole business once again.

Ingredients for semisweet chocolate glaze:
4 oz. semisweet chocolate
2 oz. sweet butter

Method:

1. Combine the semisweet chocolate pieces with the butter in a small double boiler over medium heat. When the chocolate is melted stir the mixture with a wire whisk until it is smooth.

2. Remove the chocolate from the heat and set it in the refrigerator to cool. Stir it occasionally until it is thick enough to spread without running down the sides of the brownie.

3. Spread the glaze on the brownie with a narrow-blade spatula, and place the brownie in the refrigerator until the glaze is set.

chocolate, the type used solely for cooking, is chocolate liquor that has simply been molded into blocks without further treatment. It contains roughly 53 percent cocoa butter. Eating chocolate is further enhanced with cocoa butter, sugar, milk, vanilla, and other ingredients. The addition of these ingredients varies according to the type of chocolate being made. The three main varieties of eating chocolate are: bittersweet chocolate, sweet chocolate, and milk chocolate. Throughout the world chocolate manufacturers have their own carefully guarded secret formulas for making each of these varieties.

Ready-to-eat chocolate is also conched. Conching is a process that mellows the flavor of chocolate by evaporating excess moisture and volatile acids from the mixture. This unique process, which continues for several days, mixes the finely ground and blended chocolate at temperatures ranging from 130 to 160 degrees F while exposing it to a blast of fresh air.

Whatever the end product, and however it is made, chocolate is without a doubt one of the world's favorite foods. It is my hope that the simple, but fun recipes in this article will demonstrate for you that the cacao tree truly produces fruits deserving the title "food of the gods."

No-brain chocolate fudge

While growing up I watched my mother make tons of chocolate fudge and I don't remember ever seeing a recipe in her hand. I was convinced that even a novice candy maker like myself could make fudge. When I found what I believed to be her secret unseen recipe, I was sure that I had found a no-brain road to success. All of those years watching her breeze through batch after batch of fudge, without any difficulty, gave me a false sense of confidence. So I set my mom's instructions aside, convinced that I could make fudge as well as she did.

After my third successive failure, however, my ego was displaced with a wave of common sense. In a desperate effort to avoid complete frustration I decided to sit down and carefully read my mother's detailed notes on fudge making. When I finished reading, I clearly understood what I was doing wrong. I also, for the first time, understood the true extent of my mother's candy making talent.

Fudge, according to my mother, is a special type of candy, because it can be made in an infinite number of flavor varieties. Each variety has some subtle differences in preparation. "But remember," she would say, "regardless of the variety, fudge is only a simple candy. And candy is easily

Old-fashioned hot chocolate

This recipe was given to my mother by a Jamaican woman who lived a few blocks from us. Mrs. Wheatly and my mother were always swapping recipes. My mom's notes say the recipe is Mrs. Wheatly's version of a 19th century French recipe she brought from Jamaica. As I said earlier, the rich mocha almond aroma of this wonderful hot chocolate will fill every room of your home. Also, it is not overly sweet, so you may want to have a sugar bowl at the table for those guests with a sweet tooth.

Ingredients:

2 cups whole milk
4 oz. bittersweet chocolate, chopped into pieces
2 Tbsp. granulated sugar
1/8 tsp. Kosher salt
2 Tbsp. unsweetened, Dutch process cocoa powder
1½ cups your favorite coffee, hot
1 cup light cream
1 Tbsp. pure almond extract
fresh whipped cream

Method:

1. Combine the milk and the chocolate pieces in a heavy-bottomed sauce pan over moderate heat. While stirring constantly with a wire whisk, heat the mixture until the chocolate is completely dissolved and the mixture is smooth.

2. Stir in the sugar, salt, and cocoa powder. Bring the mixture to a simmer and add the hot coffee and the light cream. Simmer the mixture for about 5 minutes.

3. Remove the cocoa from the heat, add the almond extract and serve immediately.

For an extra treat add a dollop of fresh whipped cream or a marshmallow. If you dare, add a little black pepper to taste.

made simply by cooking a concentrated sugar solution to the right temperature, then controlling how you bring it back to room temperature."

All of this sounded easy to me, until I tried it. I had to go back to my mom's "fudge for dummies" notes for help. In short, this is what I learned:

Most fudge starts out as an 85 percent sugar syrup consisting of about a two-to-one sugar-to-liquid mixture. This is also called a saturated solution because the amount of sugar that can be dissolved in the liquid is at its limit. If any more sugar is added, even the smallest amount, it will not dissolve in this solution. But, if you now cook this mixture, much of the water evaporates, and the mixture becomes super saturated, that is, the mixture now has more sugar in solution than it should to be stable. But as long as the solution stays hot this super saturation is not a problem and the excess sugar will not precipitate out. But, as the solution starts to cool, it gradually becomes thick and sluggish. This slows the movement of the sugar molecules. Under these conditions the slightest disturbance of the mixture can cause these slow moving excess molecules to fall out of solution. This action continues until the solution is, once again, in saturated balance. Everything would probably be fine if all of these loose sugar molecules would just go away, but they don't. They hang out in the form of large ugly crystals that can make fudge dry and ugly. Fudge that has fallen victim to the precipitation monster usually has a sawdust texture.

Nanna V would also caution: "Never make fudge on a rainy day. All of that moisture in the air gets sucked into your fudge while it is cooling and turns it soft and runny. Also, once you start beating the fudge, don't stop until it is ready to mold into the pan. If you stop beating before the fudge is ready, those large ugly sugar crystals start forming. The only way to keep them under control is to keep stirring."

By following the simple preparation method accompanying my mom's recipe, you will be able to make delicious chocolate fudge every time, even if you don't understand the science behind the whole procedure. All you need is a heavy-bottom sauce pan, a strong wooden spoon, a candy thermometer, a strong arm for stirring, and a Nanna V chocolate fudge recipe.

The candy thermometer is the easy way to determine when a sugar solution reaches the soft ball stage. Depending on the type of fudge being made, the soft ball stage will be reached when the mixture reaches a temperature from 234 to 240 degrees F. This fudge will be at soft ball stage when the candy thermometer reads 238 degrees F when the weather is warm. When the weather is cold and dry it will reach soft ball at 236 F.

In my next column I will dig further into Nanna V's candy making notes. Making candy at home can be a rewarding family activity. Remember, all you need to make candy is water, sugar and a little know how. Δ

THE IRREVERENT JOKE PAGE

(Believing it is important for people to be able to laugh at themselves, this is a new feature in *Backwoods Home Magazine*. We invite readers to submit any jokes you'd like to share to *BHM*, P.O. Box 712, Gold Beach, OR 97444. There is no payment for jokes used.)

In a transatlantic flight, a plane passes through a severe storm. The turbulence is awful, and things go from bad to worse when one wing is struck by lightning. One woman in particular loses it. Screaming, she stands up in front of the plane. "I'm too young to die!" she wails. Then she yells, "Well, If I am going to die, I want my last minutes on Earth to be memorable! I've had plenty of sex in my life, but no one has ever made me feel like a woman! I've had it! Is there *ANYONE* on the plane who can make me feel like a *WOMAN*?!"

For a moment there is silence. Everyone has forgotten their own peril, and they all stare riveted at the desperate woman in front of the plane. Then, a man stands up in the rear of the plane. "I can make you feel like a woman," he says. He's gorgeous-tall, built, with long, flowing black hair and jet black eyes. He starts to walk slowly walk up the aisle, unbuttoning his shirt one button at a time.

No one moves.

The woman is breathing heavily in anticipation as the stranger approaches. He removes his shirt. Muscles ripple across his chest as he reaches her, and he extends the arm holding his shirt to the trembling woman and whispers: "Iron this."

Submitted by John Allen

Everybody on earth dies and goes to heaven. God comes and says, "I want the men to make two lines. One line for the men that dominated their women on earth and the other line for the men that were dominated by their women. Also, I want all the women to go with St. Peter."

With that said and done, the next time God looked, the women were gone and there were two lines. The line of the men that were dominated by their women was 100 miles long, and in the line of men that dominated their women, their was only one man.

God got mad and said, "You men should be ashamed of yourselves. I created you in my image and you were whipped by your mates. Look at the only one of my sons that stood up and made me proud. Learn from him! Tell them my son, how did you manage to be the only one in this line?"

And the man replied, "I don't know, my wife told me to stand here."

Submitted By John Allen

Microsoft announced recently that the introduction of their new, Windows 2000 operating system will be delayed until January 1, 1901

Submitted by Don L. Fallick

A WORD GAME

The Washington Post's "Style Invitational" asked readers to take any word from the dictionary, alter it by adding, subtracting, or changing one letter, and supply a new definition. Here are the 1998 winners.

Foreploy: Any misrepresentation about yourself for the purpose of obtaining sex.

Doltergeist: A spirit that decides to haunt someplace stupid, such as your septic tank.

Sarchasm: The gulf between the author of sarcastic wit and the recipient who doesn't get it.

Shtupfather: Woody Allen.

Reintarnation: Coming back to life as a hillbilly.

Guilllozine: A magazine for executioners.

Karmageddon: It's like when everybody is sending off all of these really bad vibes, right? And then, like, the Earth explodes and it's like a serious bummer.

Dopeler effect: The tendency of stupid ideas to seem smarter when they come at you rapidly.

Intaxication: Euphoria at getting a refund from the IRS, which lasts until you realize it was your money to start with.

GUY TALK

"I'm going fishing."
Really means: "I'm going to drink myself dangerously stupid and stand by a stream with a stick in my hand while fish swim by in complete safety."

"It's a guy thing."
Really means: "There is no rational thought pattern connected with it, and you have no chance of making it logical."

"We're going to be late."
Really means: "Now I have a legitimate excuse to drive like a maniac."

"Take a break, honey, you're working too hard."
Really means: "I can't hear the game over the vacuum cleaner."

"That's interesting, dear."
Really means: "Are you still talking."

"Hey, I've got my reasons for what I'm doing."
Really means: "I sure hope I think of some reasons pretty soon."

"I can't find it."
Really means: "It didn't fall into my outstretched hands, so I'm completely clueless."

"I'm not lost. I know exactly where we are."
Really means: "I'm lost. I have no idea where we are, and no one will ever see us alive again."

"I don't need to read the instructions."
Really means: "I am perfectly capable of screwing it up without printed help."

1st Moron: "Do you know that when the Titanic sank, and all those people drowned, they were only two miles from land?"
2nd Moron: "Really? Which direction?"
1st Moron: " Straight down."

Why do they bury lawyers 50 feet underground?
Because deep down, they're really nice guys!

OFFENSIVE JOKES

Marriage Jokes:

Q: If your wife keeps coming out of the kitchen to nag you, what have you done wrong?
A: Made her chain too long.

Q: If your husband keeps stumbling around the backyard, what should you do?
A: Shoot him again.

Quotes from Hollywood:

"Now they show you how detergents take out blood-stains, a pretty violent image there. I think if you've got a T-shirt with a bloodstain all over it, maybe laundry isn't your biggest problem. Maybe you should get rid of the body before you do the wash."
— Jerry Seinfeld

"If God doesn't destroy Hollywood Boulevard, he owes Sodom and Gomorrah an apology."
— Jay Leno

"I met a new girl at a barbecue, very pretty, a blond I think. I don't know, her hair was on fire, and all she talked about was herself. You know these kinds of girls: 'I'm hot. I'm on fire. Me, me, me.' You know. 'Help me, put me out.' Come on, could we talk about me just a little bit."
— Garry Shandling

"Sometimes I think war is God's way of teaching us geography."
— Paul Rodriguez

Miscellaneous quotes:

I believe in making the world safe for children, but not our children's children, because I don't think children should be having sex.

If a kid asks where rain comes from, I think a cute thing to tell him is, "God is crying." And if he asks why God is crying, another cute thing to tell him is, "Probably because of something you did."

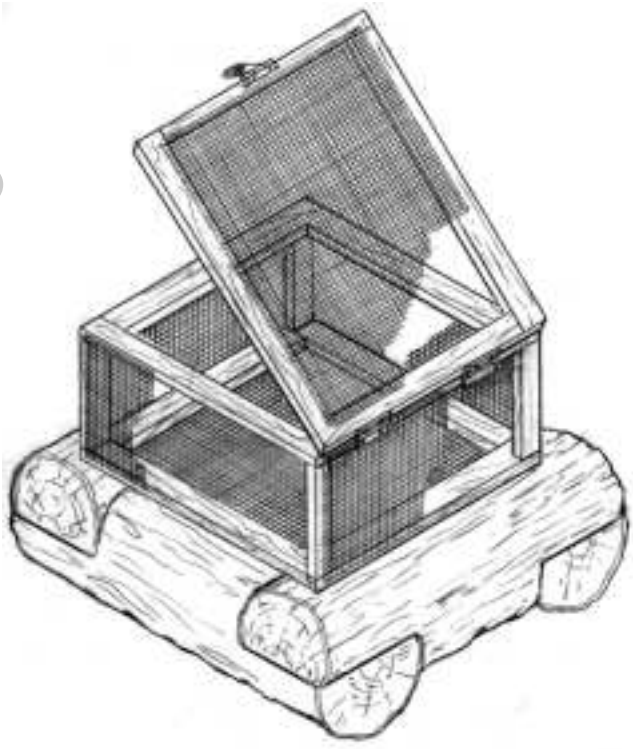
I can picture in my mind a world without war, a world without hate. And I can picture us attacking that world, because they'd never expect it.

If I ever get real rich, I hope I'm not mean to poor people, like I am now.

I hope after I die, people will say of me: "That guy sure owed me a lot of money."

CATCH MORE FISH WITH THIS SIMPLE FEEDER

BY REV. J.D. HOOKER



Spring is almost here, and for many of us that means an incredible amount of work is waiting to be done. Garden beds have to be tilled and planted, fences mended, and everything that broke down during the winter needs to be fixed. Like most other country folk, during the spring season I get to feeling fortunate when I'm finally able to sneak in an hour or two to relax a little. In fact, no matter how busy I get, or how hard I wind up working, fishing seems to become the single uppermost thought on my mind. Any time I can manage to squeak in even a couple of "spare" hours, I'm out on the water. And my wife doesn't mind, either. Who do you think is usually fishing with me?

As difficult as sneaking in the odd hour or so for fishing, it really helps to have a place where you are guaranteed a good catch. Which is why, what my wife calls "Joe's Fishing Insurance Policy" seems to be such a great idea

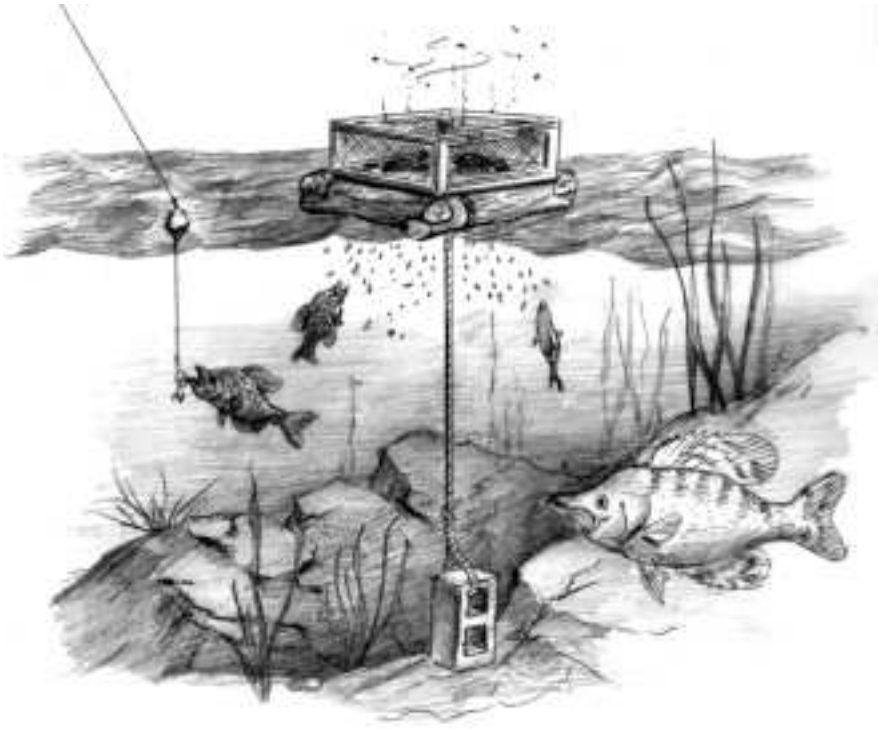
The principle behind this idea is simple. Have you ever noticed how panfish seem to congregate around the docks where folks clean their catches and toss the scraps back into the water? It's very much like the manner in which truckers pile into really good highway restaurants or politicians hover around money. As long as there's some sort of cover (weed beds, drop-offs, piers, and the like) where fish can hide and find any sort of steady, easily obtained food supply, they're going to congregate.

As simple as this idea sounds, I've found that the concept seems pretty revolutionary to many people. But, from only a few short pieces of logs, a few lumber scraps, some hardware cloth, a piece of rope, and a large rock you can quickly assemble a feeder which will practically guarantee you'll always bring home nice catches. I've got two or three such fish feeders set out in fairly secluded locations on every lake and pond we fish regularly, and I long ago learned that they really pay off.

To fashion one of these super-efficient fish attracters for yourself, assemble the simple box-like wooden framework illustrated above. Use whatever lumber you have handy and build this project to whatever size would seem appropriate for your own use. (The guide I learned about this from liked a 3'x4'x18" box). Next, you'll need to cover this framework with ½-inch mesh galvanized hardware cloth. You'll need to put together a mesh-covered lid like the one shown, as well, or you'll wind up feeding birds rather than the fish.

Normally I'11 use roughly 8-inch diameter sections of logs, notched and nailed together as shown, to shape the raft upon which this cage-looking feeder floats. Then galvanized nails are used to affix the feeder atop the raft. A length of poly or nylon rope, long enough to reach from the lake bottom to the high water level (I'll always add a few extra feet just in case), is also needed. After attaching an old cinder-block, a few bricks, or some other anchor to one end of the rope and the feeder to the other, it is set out in a likely fishing spot and just left there.

Now, you'll need to place something which will readily attract flies inside of your fish feeder. For our first trip out each spring, I like to use any sort of meat scraps, but spoilt fruit or vegetables work well enough if such scraps aren't available. After that first



trip, fish heads and other refuse from our catches go inside the feeders.

This sort of bait doesn't actually feed, or even attract any fish. What it does do is draw flies by the thousands. While feeding on the refuse, the flies also lay their eggs. Then, quicker than seems possible, the eggs hatch into masses of crawling maggots. While as the feeder bobs around on the surface of the water, the maggots just naturally keep falling through the mesh floor and sink into the water, drawing a pretty large number of fish to feed. This means that worms and most other baits let down on a hook near this feeding station will usually produce near instant strikes.

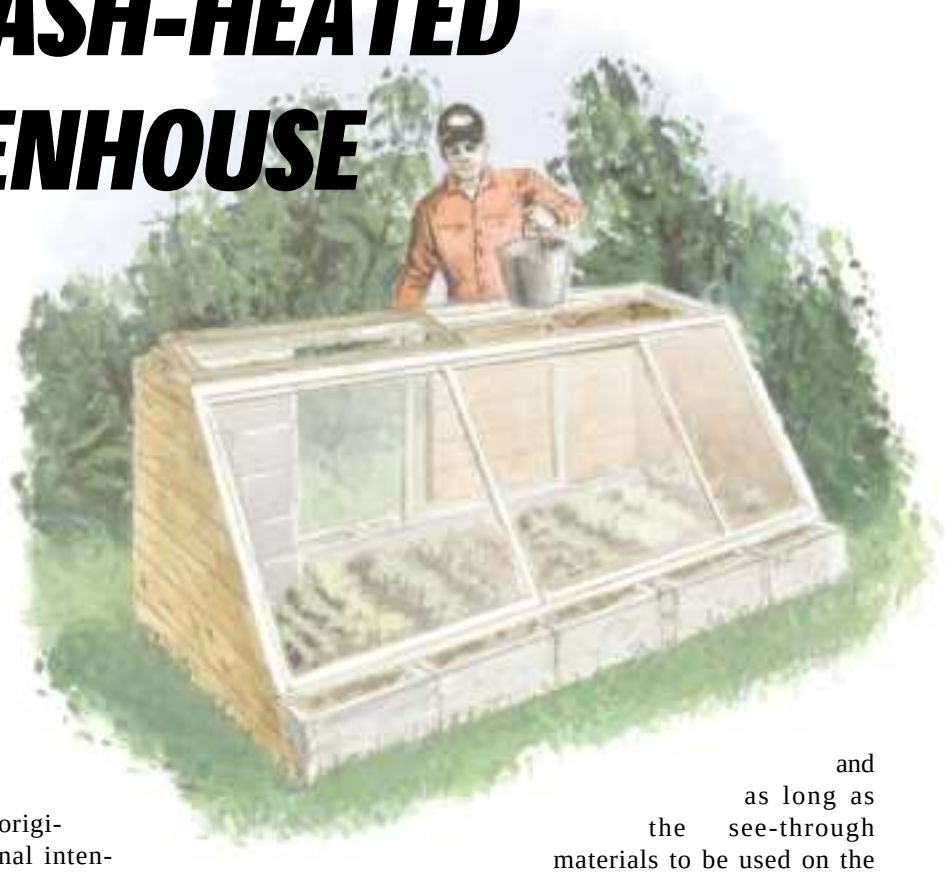
After using fish feeders of this type for several years, we've found that generally the larger panfish will hold a little deeper than the smaller ones in the vicinity, while the bass and other larger fish striving to prey on the panfish are usually out in the peripheral areas. At times, we've also taken some pretty nice cats right off the bottom near such feeders.

With the ever present flies and other insects constantly buzzing around these feeders, hand-tied flies and other small surface-riding artificials, are normally very productive as well. Of course, you'll also find there will always be a few well-fed fish hanging around your feeders that are just a little too wily to hook. This is actually a good thing as it ensures that you're leaving plenty of nice fish to breed for fishing trips in future years. In fact, I've found that after using such feeding stations for about four or five years, the sizes of the individual fishes in each location have increased considerably.

Whether your own fishing is done on a lake, river, pond, or wherever, I know you'll be pleased with the results should you decide on using a similar feeding station to ensure your own catches. One thing I hope you'll remember, though: since this sort of feeder all but guarantees quick and relatively easy catches, fishing near one is a really terrific way to introduce youngsters new to this sport, to the laid-back pleasures of fishing.

Now that I've finished typing this up, I think I'll go fishing.Δ

BUILD AN ASH-HEATED MINI-GREENHOUSE



By Robert L. Williams

You don't have to be a scavenger to build this mini-greenhouse for less than five cents, but it helps.

If you were to go out and buy the materials used in this mini-greenhouse, you could easily spend two or three hundred dollars.

But the whole idea is to build it for nothing. Or at least nearly nothing. Start to work by looking around your house and property for anything that can be used to hold heat in and keep cold out. You might be surprised at what you find.

You'll be even more surprised to learn how it's heated. First things first, though. Why build a tiny greenhouse? The answer is obvious: to keep your tiny and tender plants from freezing and to save money on the cost of seedlings next year at garden season.

What is a mini-greenhouse? In this case it's a cross between a cold frame and a greenhouse. The structure, if you could call it that, is heated, however, and therefore it's not a cold frame. But it's too small to be a real greenhouse.

How do you build one for nothing? Or nearly nothing? Because we never throw anything away, we always have in one of our outbuildings something that will work. In this case, we had two old storm doors that we used on an earlier house. When the house went, the doors stayed, largely because there's always a chance that such a device might be useful. Our original intention was to use the doors on a workshop that we might one day build. We also found some doors out of an old bookcase, as well as some windows from an old building. You probably have something of the sort around. If not, you can buy some thick polyurethane or some form of plastic covering.

We salvaged or re-cycled everything in the mini-greenhouse, and I mean everything. Here's the order in which we assembled the collection of has-been stuff.

First, dig a small trench wide enough to hold a series of old concrete blocks or bricks. We used blocks for two reasons: first, we had them, and second, we wanted to fill the cores with dirt in order to have more insulation. Dig the shallow trench about five inches deep, eight inches wide (or wider, if you have 12-inch blocks), and as long as the see-through materials to be used on the front and back. If you are using old windows, the size of the windows will determine the length of the trench.

When the trench is completed, leave loose dirt in the bottom so that you can wiggle blocks enough to seat them in order to give you a reasonably level base.

Now, when the blocks are fitted end-to-end and are basically even, fill the blocks with dirt and pack the dirt fairly tightly. Then drive a small but sturdy stake into the dirt in the cores of the end blocks.

Now construct from old scrap lumber an inverted shortened vee shape and nail it together. The finished product should look a little like the framing of a roof with a flat section. At the bottom of the frame nail a type of furring strip from one end to the other of the structure, and then on top of the strip nail a piece of wood that is at least an inch wider than the first strip.

The result should be a grooved space wide enough to let the edge of the old storm door slide down into it so that the door will be held stable.

Do the same for the back side, unless you don't plan for the back side to be exposed to direct sunlight. In that case, you can use wood, metal roofing, or anything else that will keep out the cold.

Use two strips of wood to connect the two parts of the vee-frame. These strips should be long enough for you to fit the top windows in the space. If you are using plastic sheeting, you do not need to have the flat area at all.

But we wanted to have sunlight from the east on the back side of the structure, from straight above at noon, and from the west in the afternoon.

You need very little carpentry skills to do this work, and you don't need many tools. You can use plastic to close in the ends, or you can use wood. We used some very old and nearly rotten wood that we started to burn but for some reason didn't.

When the frame is done, all you do is lay the old doors or windows in their positions and let the sun and a little help from the woodstove do the rest.

If you want to do a neater job, you can build a sort of lean-to against the foundation wall. In this way you get the heat that is absorbed by the cement blocks, and the only wood you need is for the slant from the ground level to the foundation wall.

If you want to attach the legs of your frame to the cement blocks, you can do as we did. I drilled a hole in the wood and in the end of the cement block. Then I cut a wooden dowel (from an old stick) and drove it into the hole. The fit is very tight, and the blocks give stability to the greenhouse.

How do you heat this monstrosity?

When I said everything was recycled, I meant everything. That includes the ashes we use for heating.

We placed the mini-greenhouse in the middle of one of our garden spaces. There was a reason for that, too. In the middle of the day, actually every two days, we usually shovel out the ashes from our woodstove. The ashes always have hot coals, so we were reluctant to dump the ashes onto the garden, for fear that a spark might ignite high grass and create a tragedy. So we solved two problems. In the past we noticed that when we carried the ash bucket out and set it on a brick bed for safety's sake, the bucket would still be giving off heat two days later, even in the coldest weather.

So now, we shovel out the stove ashes in the late afternoon, and we carry the bucket to the garden space, open the door simply by leaning the storm door outward, and then we set the ash bucket on a small bricked area in the center of the mini-greenhouse.

The heat from the ash bucket keeps the tiny greenhouse warm all night, and the next day the sun warms the cement blocks and adds to the warmth. On the second night there is still heat in the ash bucket, and on the third day we can safely spread the wood ashes across the garden space. The ashes are dead by this time, and there is no danger of fire.

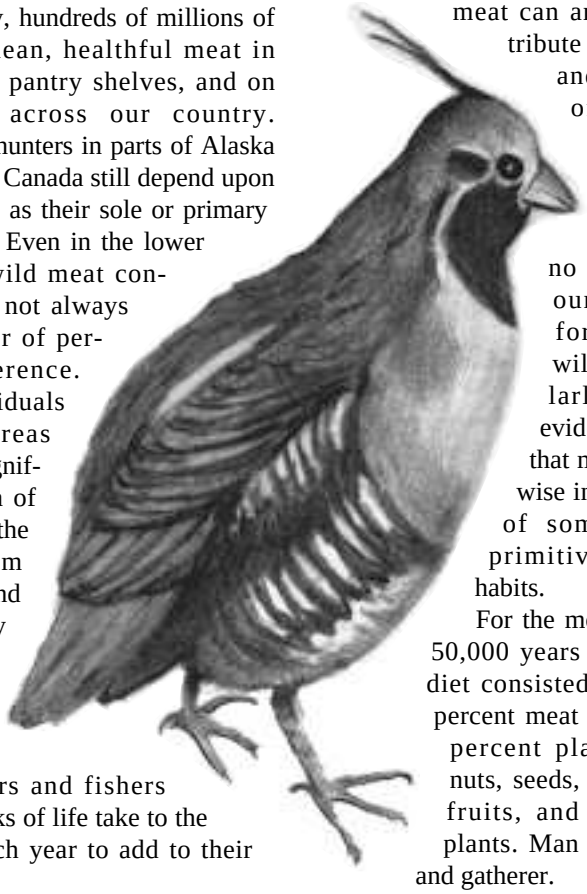
So we found a safe way to let our ashes cool, and at the same time we heat the mini-greenhouse at no cost. For a third benefit, we have the greenhouse handy to the garden, so that we can spread the ashes without taking extra steps.

Now, what do you grow in such a space? We start seeds for the summer garden so that when the danger of frost has passed we can have health-sized plants. We also break off tomato suckers in the early fall and root the suckers. In this way, we keep last summer's tomato plants alive during the winter and into the summer. Then we will break off more suckers and in this way keep the same tomato plants going year after year. Δ

Compare the nutrition in wild meats to supermarket meats

By Charles A. Sanders

Most of us who hunt do so to provide meat for the table. This thought is too seldom taken into account when considering whether hunting is a valid pursuit in our "nuclear age." Each year hunting puts, literally, hundreds of millions of pounds of lean, healthful meat in freezers, on pantry shelves, and on tables all across our country. Subsistence hunters in parts of Alaska and northern Canada still depend upon wild animals as their sole or primary food source. Even in the lower 48 states, wild meat consumption is not always just a matter of personal preference. Many individuals in rural areas provide a significant portion of the meat for the table from wild game and thereby stretch or replace dwindling food dollars. Hunters and fishers from all walks of life take to the outdoors each year to add to their larder.



In Wisconsin alone, for example, an estimated 400,000 deer were taken during a recent hunting season. They yielded, at an average dressed weight of 100 pounds per deer, 40 million pounds of meat. In addition, the fields and waterways of the state yielded additional millions of pounds of small game animals, gamebirds, waterfowl and fish to hunters and fishers. Each of the 49 other states can boast similar numbers with their own indigenous species providing comparable quantities of meat for hunters in their states.

As a result, the use of wild meat can and does contribute to the health and well-being of North American families.

It should come as no surprise that our primitive forebears ate wild meat regularly. Further, evidence suggests that modern man is wise in his imitation of some of those primitive dietary habits.

For the most of the last 50,000 years or so, man's diet consisted of about 34 percent meat and about 65 percent plants such as nuts, seeds, roots, tubers, fruits, and leafy green plants. Man was a hunter and gatherer.

Agriculture came along much more recently. Cultivated grains were not introduced to the diet until about 10,000 years ago and dairy products came into use only in the last 6,000 years or so. In other words, primitive man not only subsisted but thrived on a diet based on only two of the basic food groups considered today to be essential to good health. In fact, he managed to get an average daily intake of about 1,500 mg of calcium, without consuming any dairy products at all. That level is at least 50 percent greater than is usually recommended for us today. Early man did have one thing in his favor, however. The *quality* of his food was significantly better than that of today. Contributing to that difference is the fact that wild meat is nutritionally superior to the meat from domestic animals.

It only makes sense. Wild meat is some of the most healthful which we can consume. No domestic animals are more humanely raised than the wild animals which roam our fields and forests. It is naturally lean and flavored by the wide variety of high quality natural foods instinctively chosen by the animals, and is not subjected to the hormones or chemical additives found in so many commercially raised meats. Wild animals also get plenty of exercise in both hunting for their own food and trying to escape predators which would devour them.

Farm animals, on the other hand, are force-fed synthetic feed mixtures designed to put on weight. They are also confined to small areas where they can't get enough exercise. For these reasons, primitive man ate meat which was only about four percent fat, compared to our traditional beef, which is up to 30 percent body fat. A high fat intake has been linked to

increased risks of both heart disease and cancer. Incidentally, primitive man himself was only about four percent body fat. He consumed very little fat, absolutely no junk food, and got plenty of exercise just trying to catch his dinner.

Another important difference is that wild game contains a substance called E.P.A., whereas domestic animals do not. E.P.A. (eicosapentaenoic acid) is a protective fatty acid which improves the flow characteristics of blood. It acts as a sort of natural antifreeze to keep the fluids and organs of wild animals from becoming stiff in even the most frigid weather. Not surprisingly, the colder the climate, the more E.P.A. wild game contains. It is even found in higher concentrations in their legs and hooves—which make contact with the snow and cold ground—than in their torsos. Scientists are just now discovering that E.P.A. in the human diet can be a protective factor against heart attacks, atherosclerosis (hardening of the arteries), and certain forms of arthritis.

Nutritionally, wild meats compare very favorably with domestically raised meats. In many cases, some nutritive values exceed those of similar domestic counterparts.

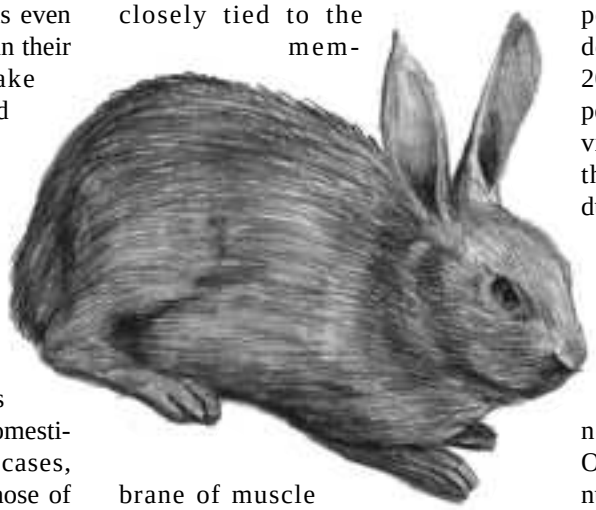
Generally speaking, nutritional information on wild game species is less comprehensive than on more commonly consumed meats. Two areas of current interest are cholesterol and fat content in foods, especially in "red" meat.

Most game meats, except bear and raccoon, are relatively low in fat. With a few exceptions, cholesterol values are similar among meat, poultry, fish and game. While antelope, caribou, venison, wild rabbit, and veal tend to have slightly higher cholesterol content than other meats, they should not be put at a nutritional disadvantage since they are lower in total fat than some other meats.

Remember, current dietary recommendations advise Americans to reduce total fat and saturated fat in the diet and to limit daily dietary cholesterol. Trimmed 3.5 oz. portions of game products as listed in the accompanying table can easily be included in meals consistent with those recommendations.

If the hunter or a family member has heart problems, he or she will benefit from knowing the cholesterol and fat content of what they bring home.

A concerned consumer needs to first understand that cholesterol is an integral part of the cell membrane of animals and so the cholesterol content of meat is actually more closely tied to the membrane of muscle cells than to the fat content of the muscle. This means, as a rule of thumb, that game meat tends to have the same amount of cholesterol as beef or pork. However, since game gets more exercise, game meat has considerably less fat than domestic meat.



Hunters also like the organ meats. They should keep in mind that the cholesterol of heart muscle is 275 mg/100 g of tissue but is low in fat. Liver is, of course, a rich source of cholesterol at 450 mg/100g. The extent of worry about these figures should be balanced with how often these organ meats are eaten. If liver and onions is eaten once or twice a year, then a moderate portion should not cause problems.

In the accompanying table, you can see how wild meats from fish, birds, and animals compare to many domestic livestock species in supplying many of the basic nutrients essential to our health and vitality.

In reviewing the table, note that the fat content of domestic animals is, on the average, nearly four times as much for the wild ones. Notice also that domestic duck has only about 70 percent of the protein but 350 percent of the fat of wild duck. Diet and exercise are the obvious factors responsible for these differences.

Note that wild game provides, on the average, 200 percent of the calcium, 240 percent of the iron and over 300 percent of the vitamin B-2 found in domestic meats. Wild duck has over 200 percent of the calcium, over 350 percent of the iron, 170 percent of the vitamin B-1 and over 350 percent of the vitamin B-2 found in domestic duck.

In any recipe, most wild meat can be readily substituted for meat from the supermarket or butcher shop. If the game is killed quickly, dressed properly, and handled carefully, there is no good reason for anyone not to enjoy the taste of wild meat. One important tip to preserving the nutritional value and flavor of fish and wild game is to be careful to never overcook it.

The more you experiment with different types of wild game in your cooking, and the more creative you are in the seasoning you try, the more comfortable and accomplished you will become at cooking wild fare.

Simply put, using wild animals for food, as well as for hides, furs, and other articles involves personal choices. Whether we choose to hunt and use wild meat is up to us. But it remains a valid and important part of our country and the lives of millions of people. Δ

NUTRITIVE VALUE OF WILD GAME (3.5 oz. portions)

Species	Calories	Fat (%)	Chol. (mg)	Protein (%)	Calcium (mg)	Iron (mg)	Sodium (mg)	Zinc (mg)	B-1
Antelope Pronghorn	148	2.67	113	29.45	4	4.2	54	1.68	na
Bear, Black	259	13.39	na	32.42	5	10.73	na	na	.16
Bear, Polar	na	3.3	na	25	17	6.1	na	na	.023
Bear, Brown/Grizzly	259	na	na	32.42	.5	10.73	na	na	.16
Beaver	166	5.45	na	29	26	5.8	46	na	.08
Beef	158	26	69	26	11	3.1	na	na	.07
Beef, ground, lean	264	na	75	17.69	8	1.77	69	3.86	.05
Buffalo	146	2.42	45	28.44	na	na	na	na	na
Caribou	167	4.42	109	29.77	22	6.17	60	5.26	.67
Chicken, domestic	140	8.2	58	28	15	1.6	na	na	.06
Deer, Mule	151	3.19	85	30.21	10	4.47	54	2.75	.23
Deer, Sitka, raw	117	na	18	21.5	7	2.9	na	na	.2
Deer, Whitetailed	153	3.19	113	30.21	10	4.47	54	2.75	.23
Duck, domestic	na	7.8	na	21	12	1.3	na	na	.1
Duck, Mallard	154	2	143	29	26	4.8	na	na	.17
Duck, breast	123	na	na	20	na	4.5	na	na	na
Elk	146	1.9	73	30.19	5	3.63	61	3.16	na
Goat	143	3.03	75	27.1	17	3.73	86	5.27	na
Goose, Canada	171	39	105	na	na	na	na	na	na
Goose, Snow	na	2.2	na	29	26	4.8	na	na	.23
Goose, Snow, breast	130	na	142	23	na	na	na	na	na
Grayling, Arctic	93	na	57.6	20.5	.35	1	81	na	.07
Grouse, Sharptail	108	na	105	24	na	4.8	na	na	na
Horse	175	6.05	68	28.14	8	5.03	55	3.82	na
Lamb	na	27	na	25	11	1.4	na	na	.13
Moose	134	.97	78	29.27	6	4.22	69	3.68	.02
Muskrat	234	na	na	30.09	36	na	95	na	na
Opossum	221	10.2	na	30.2	na	na	na	na	na
Pheasant	149	6	49	24	na	1.2	na	na	na
Pheasant, breast	116	na	52	26	na	1.2	na	na	na
Pike, Northern	88	na	na	18.3	na	.6	na	na	na
Porcupine	na	1.1	na	24	23	5.2	na	na	.14
Pork	165	27	71	20	10	2.9	na	na	.5
Ptarmigan, raw	128	na	20	24.8	na	6.2	na	na	.25

Quail	134	na	na	22	na	4.5	na	na	na
Quail, breast	123	na	na	23	na	2.3	na	na	na
Rabbit, wild	173	3.51	77	33.02	18	1.6	45	na	.06
Rabbit, domestic	154	6.31	64	22.78	15	1.78	37	1.78	na
Raccoon	255	14.5	na	29.2	na	na	na	na	na
Reindeer, raw	127	na	16	21.8	16	5.3	na	na	.33
Salmon, King, dried	428	na	139	51	28	2	139	na	.15
Salmon, King, cooked	214	na	65	23.3	39	2	62	.56.	026
Salmon, King, canned	150	na	na	23.2	60	1.8	na	na	.01
Salmon, Pink, cooked	149	na	na	25.56	na	.99	86	.71	na
Salmon, Coho, cooked	185	na	49	27.36	na	.89	59	.52	na
Salmon, Red, cooked	216	na	87	27.31	7	.55	66	.51	.215
Scoter, White-winged	90	na	na	20.2	8	na	na	na	na
Seal, Ringed	150	3.9	90	28.4	5	19.6	110.1	na	.14
Seal, dried	243	na	na	46	19	35.1	na	na	.174
Smelt, dried	361	na	na	59.3	na	na	na	na	.01
Squirrel	149	3.65	83	24.13	2	5.34	94	na	na
Trout, Dolly Varden	100	na	53	19.7	13	1.3	102	na	.05
Turkey, domestic	146	15	60	31	7.8	1.8	na	na	.04
Turkey, Wild	158	11	58	na	na	na	na	na	na
Turkey, Wild, breast	121	na	55	26	na	na	na	na	na
Walrus	200	na	80	19.2	18	9.4	na	na	.18
Walrus, dried	267	na	na	57	na	43	na	na	.21
Whitefish, dried	412	na	284	69	65	.9	na	na	.06